# THE PRINCIPLES OF LOGIC

## DEDUCTIVE AND INDUCTIVE


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To

The Revered Memory

of

My Dear Father,

THE LATE BABU HARISHCHANDRA MITRA.

# PREFACE.

Lectures delivered to my students formed the nucleus of this book. It is thus adapted to the requirements of the candidates for the Intermediate Examination in Arts and is suited to their capacity. I have tried to explain in these pages the main principles of logical science, overlooking minor details and controversies. It is, I think, an important part of an educator's function to select judiciously what is needed for young minds, thus excluding what might prove burdensome to them. I do not know to what extent I have succeeded in presenting before a beginner in logic the most salient points of this important branch of study. All that I can say is that I have tried to do so; and, I believe, it has, to a certain extent, been possible owing to the comparatively non-controversial aspect of logical doctrine.

To make the subject interesting, I have illustrated principles and rules by examples and have added numerous problems for solution. I have given, at the end of almost every chapter, hints for working out exercises which will, I hope, be of some use to students. Many of the questions included in the exercises have been taken from papers set at the University Examinations, and some have been taken from the works of Drs. Whately, Jevons,

Keynes, and Ray. My indebtedness to other writers is generally acknowledged in proper places; and my thanks are due to my pupils who have kindly supplied me with copies of my lectures. The arrangement of topics is indicated at the end of Chapter I.

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THE

# PRINCIPLES OF LOGIC,

## DEDUCTIVE AND INDUCTIVE.

## BOOK I.

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## INTRODUCTION.

## CHAPTER I.

### THE DEFINITION AND SCOPE OF LOGIC.

Logic aims at determining truth which involves consistency.

§ **1. What is Logic?** Logic, as the etymology of the word (Gr. *logike*, from *logos*, reason, speech) indicates, has to do with the right use of reason and speech for the attainment of truth and avoidance of error. But the essence of truth generally lies in agreement, harmony, or consistency, the absence of which implies confusion, discord, and error. When, for example, on seeing a cord I take it to be a snake, I am said to be in error, because my inference is not consistent with fact. I attribute to the cord the qualities of a snake which are not really found in it. In doing so, therefore, I contradict myself, in as much as I practically maintain that a cord is the same as a snake, which is not really the case. If, there-

Two sorts of consistency: (1) consistency of thoughts with things;

fore, I correct myself by abandoning the belief, then I attain truth, in as much as the factors of my thought become self-consistent, my impression of the rope fits in with its other qualities. Similarly, when I say that crows are quadrupeds, that men walk on their heads, or that horses can fly in the air, my statements are taken as false, because they do not agree with facts ; and if, on any occasion, any one or all of them be found to be consistent with the actual order of things, they would be held no longer as false but as true. Thus, our thoughts or statements are said to be true when they are in harmony with facts.

(2) consistency of thoughts with one another.

But besides the agreement of thoughts with things, there is the agreement of thoughts with one another. When, for example, I try to think of a round square or of a biped quadruped, I find that I am unable to realize it in thought, as the different elements of the concept conflict with each other. I am thus in error and can attain to truth only by removing the contradiction involved in the conception. If I, likewise, hold that the blind can see, that matter is not extended, or that I am present and not present at the same time, then these statements are rejected as false because they are suicidal, involving the denial, in the second part, of what has been assumed in the first : blindness, matter, and presence imply in their very nature the absence of sight, the presence of extension, and existence at a certain time and place ; while the qualities attributed (*viz.*, ability to see,

absence of extension, and non-existence at the time and place) involve the negation of these qualities. Thus the error in each case lies in inconsistency or self-contradiction among my own ideas.

Consistency consists in relations. Hence isolated experience or immediate knowledge is beyond logical test.

We say, then, that the essence of truth generally lies in consistency, either among ideas themselves or between thoughts and things. But we can speak of consistency or inconsistency only when one thing is related to another. There can be no such question when only one thing or element occupies our attention. When, for example, I see the colour bofore me as yellow or feel the sorrow within me as painful, there is no room for consistency, as each of them is an immediate experience of a single fact without reference to anything else. If, however, other individuals perceive the colour as white, or I myself subsequently discover it to be so, then my previous experience may be pronounced as false in relation to these. Thus, the question of consistency or inconsistency as a test of truth never arises in the case of direct or immediate experience.

Consistency as a test is chiefly applicable to inferences.

This test is prominently present in the case of inferences, *i.e.*, conclusions drawn from data. When, for example, I infer that all cows are red, because I find this, that, and the other cow to be so, or I conclude that all quadrupeds are cows, because all cows are quadrupeds, I am not correct because my conclusion does not follow from what is given. To generalize from two, three, or a few cases is often, more or less, precarious ; and it is, likewise, wrong

to transpose simply the terms of a statement which are not co-extensive in character. Hence we find that inferences constitute the principal subject-matter of logical science.

Thought and language are closely connected ;

We have said above that Logic etymologically implies the right use of reason and speech for the attainment of truth and avoidance of error. We have thus indifferently spoken of the right use of reason or the right use of speech without making any distinction between them. And the reason for this indiscriminate use of expressions is that reason and speech, thought and language, are inseparably connected with each other. Indeed, the Greek word *logos* stands either for thought or for language, which are viewed as but different aspects of one and the same fact. It is doubtful whether we can think at all without the aid of language ; and, were it possible, it would be so vague and indefinite as to be excluded from the province of knowledge and science altogether. When seemingly we think without language, we really think with its help : we speak within ourselves, though we do not speak out ; thinking in such a case is carried on by suppressed articulation. Language, likewise, can have no significance without thought. An expression not standing for a thought is a jargon or unmeaning combination of words. Even a watch-word or an incantation has a sense by association, intelligible to those who know its use. An *Abracadabra* is not without its importance to believers in amulets or charms.

but thought

Though reason and speech, thought and

language, are thus closely connected with each other, yet thought is to be regarded as the soul, and language, as the body; the one is the spirit, while the other is its expression. Language is either natural, such as physical expression or pantomimic gestures, or artificial, such as a conventional system of symbols, constituting the medium of the communication of thoughts and feelings among the members of a nation or community. But these gestures or symbols by themselves are nothing; they become significant only when they convey thoughts or feelings. Even the mutterings of delirium or the writhings of agony are of any importance to us as indicating certain conditions or states of the mind or the body. Apart from such a reference, they lose their meaning altogether and turn out to be mere arbitrary signs. Thus, there can be no sense in saying that words or expressions are consistent or inconsistent apart from the consistency or inconsistency among the corresponding ideas or thoughts. Language is true or false, correct or incorrect, only by reference to the ideas expressed by it.

is the essence, and language is but its instrument.

It may, no doubt, be said that the correctness or incorrectness of language may be judged also by reference to objects and their relations; but we are concerned with these only so far as they are apprehended by us. We have nothing to do here with the realistic or idealistic controversy about the real nature of objects, nor with the inquiry, whether we have or have not an access to their real character. Things as known to us can alone be the subjects of

Thoughts and things are also closely connected;

but things and

their relations as known to us are the subjects of discourse.

discourse; so that things apart from thoughts are, for all practical purposes, of no value to us. It is immaterial for logical purposes whether we hold with the Positivists that things are mere phenomena, or we maintain with the Hegelians that they are but objectified thought-relations. In either case, we are concerned with our thoughts about things as known to us. These things and their relations are, indeed, characterized by uniformity, system, or order. But we have to do with order or system as understood by us; and truth or error has a sense to us only by reference to apprehension. The objective relations themselves, viewed apart from mind, can have no significance to us. *We may judge* them to be consistent or inconsistent among themselves, or *we may hold* them to be true or false in relation to our estimates; but in either case there must be thoughts to be compared with things before they can be judged at all. (We are concerned directly not with language, nor with things, which by themselves are of no value to us, but with thoughts and their correspondence either with each other or with things and expressions.) The consistency or inconsistency of thoughts, as well as of things and expressions so far as they are connected with them, constitutes the proper subject-matter of logical doctrine.

Logic is the science and art of consistency:

§ **2. Definition of Logic.** Logic, accordingly, may briefly be defined as the science and art of consistency. It inquires into the conditions of valid thought and lays down rules for attaining it.

On an examination of our thoughts, Logic discovers the principles which underlie correct thoughts and which we transgress when we think incorrectly. It thus distinguishes, as shown above, between correct and incorrect thoughts and formulates rules for the attainment of the one and avoidance of the other.

it discovers principles underlying correct thoughts and lays down rules for attaining them.

A science is a systematic inquiry into the laws and principles governing a definite group of facts which constitute its subject-matter. Thus Botany, as a science, aims at discovering the laws governing plants; and Physics aims at deciphering the laws of physical phenomena. An art, on the other hand, lays down rules for the attainment of a certain end. Surgery, for example, as the art of healing by manual operation, is guided by certain rules relating to the use of surgical instruments and the application of bandages. Similarly, there are arts of dyeing, painting, and printing—all guided by definite rules for the attainment of certain results. "The distinction between science and art," says Thomson, "is, that a science is a body of principles and deductions, to explain some object-matter: an art is a body of precepts, with practical skill, for the completion of some work. A science teaches us to know, and an art to do; the former declares that something exists, with the laws and causes which belong to its existence, the latter teaches how something must be produced." (*Outlines of the Laws of Thought*, pp. 11-12.) An art, however, to be sure and successful, should be based on

A science discovers principles governing a particular subeto-matter,

while an art lays down rules for the attainment of a certain end.

scientific knowledge. Surgery, for example, as it is practised by the village barber, is more or less precarious and attended with risks ; but when it is based on anatomy, physiology, and hygiene, it is comparatively sure and successful. Now Logic is both a science and an art in as much as it aims at discovering the principles on which all valid thoughts depend and also at laying down rules for securing accuracy and correctness and avoiding error and confusion. In fact, it may be described as a practical science, *i.e.*, a systematic study of the general conditions of sound thinking with a view to apply them to practice for the attainment of truth.

Logic is both a science and an art : it is a practical science.

A definition, to be correct, should set forth the exact meaning of the term defined; otherwise it is either wide or narrow.

A definition unfolds the meaning of the term defined. It should, accordingly, state neither more nor less than the signification proper : if it states less, it is wide or incomplete ; if it states more, then it is narrow or redundant. If, for example, we define 'man' as an animal, the entire meaning is not set forth, and so the definition becomes wide and applicable to lower animals as well. Similarly, when we define 'triangle' as a figure, the definition is incomplete, as it leaves out the quality of being bounded by three straight lines which marks out triangles from other figures ; and thus the definition becomes wide as it stands for any figure—whether bounded by three straight lines or not. Again, if we define 'man' as a civilized rational animal, the definition becomes narrow, as it includes more

than what is properly implied by the term. By adding the quality of being 'civilized' to the meaning of 'man', the definition unwarrantably excludes barbarians from the human category. Similarly, when we define 'triangle' as a three-sided rectilineal figure, of which any two sides are greater than the third, we are guilty of redundancy, in as much as the last clause is a superfluous addition to the meaning of the term defined. Thus a definition, to be precise, should be neither wide nor narrow. Let us now examine some of the definitions of Logic in the light of these remarks.

### I. Wide Definitions.

*I. Wide definitions of Logic:*
1. Ueberweg's definition.

1. Logic has been defined by *Ueberweg* as "The science of the regulative laws of human knowledge." (*System of Logic*, translated by Lindsay, p. 1.) The regulative laws are "the universal conditions to which knowledge must conform" in order that it may be valid. 'Knowledge', however, covers both immediate and mediate knowledge, perception and inference. But, as we have seen, Logic has nothing to do with what is directly perceived or immediately known, which must be accepted as it is and can never possibly be disputed. Even in the case of illusions, such as the mirage, the optical impressions themselves (due, in the case of the mirage, to the unequal refraction of light through different densities of the lower strata of air) cannot be ques-

tioned; it is the inference from them as to the presence of definite objects that is open to question. In including, therefore, the entire field of knowledge within the province of Logic, Ueberweg has made his definition very wide.

2. Definition of Port-Royal Logic.

2. The same remark applies to the definition given in *Port-Royal Logic.* Logic is defined by its authors as "The Science of the operations of the human understanding in the pursuit of truth." Now truth may be either intuitive (immediate) or inferential (mediate); and Logic, as we have seen, is concerned only with the latter. Moreover, if Logic aims not merely at freedom from inner contradiction but also at conformity with facts, then merely an inquiry into "the operations of the human understanding" is not adequate to the attainment of truth. We must carefully survey facts and examine 'the operations of the human understanding' in order that our knowledge may be in harmony with the real order of things.

II. *Narrow definitions:* 1. Aldrich's definition.

## II. Narrow Definitions.

1. *Aldrich* defines Logic as "The Art of Reasoning." This definition has the effect of limiting Logic only to an examination of Inferences and of excluding such topics as Definition, Division, and Classification, which fall within its province as characterized by consistency or inconsistency. Moreover, Logic is not merely an art—a knack—but also a science instituting a systematic inquiry into the conditions of valid thought.

2. Logic is defined by *Albertus Magnus* and by certain Arabian logicians as "The science of argumentation (*scientia argumentandi*)." This definition, like that of Aldrich, is also narrow; and it regards Logic simply as a science, overlooking its practical aspect as an art. The same defects are present in *Spalding's* conception of Logic as "The theory of inference."

2. Albertus' definition.

Spalding's definition.

3. *Whately* defines Logic as "The Science, and also as the Art, of Reasoning." Though Whately thus combines in his definition the theoretical and the practical side of logical doctrine, yet he too unduly narrows its province by restricting it to the sphere of reasoning alone.

3. Whately's definition.

For other definitions of Logic see sections 7 and 11.

§ 3. **Knowledge and Truth.** As Logic is concerned with Knowledge and Truth, let us consider in this section the character of these with a view to estimate aright the subject-matter of logical inquiry. Knowledge is a system of ideas corresponding to a system of facts, accompanied by a belief* in their correspondence.

Definition of knowledge.

* Belief is a primary condition of the mind, implying subjective assurance based on imperfect evidence It is involved, more or less, in all knowledge. Hamilton writes, "St. Austin accurately says—"We *know*, what rests upon *reason*; we *believe*, what rests upon *authority*." But reason itself must rest at last upon authority; for the original data of reason do not rest on reason, but are necessarily accepted by reason on the authority of what is beyond itself. These data are, therefore, in rigid propriety, Beliefs or Trusts. Thus it is, that in the last resort, we must,

The knowledge, for example, of a tree implies the presence of a system of ideas in the mind, such as those of the trunk, branches, leaves, etc., bearing a certain relation to one another, and a belief in the correspondence of these with facts. Thus, knowledge in every case implies a subjective side (*viz.*, ideas), which corresponds to an objective side (*viz.*, facts or reality), and there is a conviction of their correspondence. If any one of these factors be wanting, there cannot be any knowledge. In order to knowledge, for example, it is not adequate that there should simply be reality or facts ; the reality must be known or, in other words, there must be a system of ideas corresponding to a system of facts. But there must also be belief in the correspondence between these two sets. When such a belief is wanting there can be no *knowledge*, even though there be a system of ideas and a system

Knowledge involves ideas, facts, their correspondence, and the belief in it.

perforce, philosophically admit, that belief is the primary condition of reason, and not reason the ultimate ground of belief." (*Reid's Works*, p. 760.) The different degrees of assurance corresponding to the different grades of certainty are indicated by the words *Opinion*, *Belief*, and *Knowledge*. "Opinion," says Kant, "is a consciously insufficient judgment, subjectively as well as objectively. Belief is subjectively sufficient, but is recognized as being objectively insufficient. Knowledge is both subjectively and objectively sufficient. Subjective sufficiency is termed *conviction* (for myself); objective sufficiency is termed *certainty* (for all)." (*Critique of Pure Reason*, Meiklejohn's Translation, p. 498.) Certitude thus indicates perfect assurance due to conclusive evidence, while probability, which ordinarily underlies what we call opinion, expresses a dubious attitude of the mind, due to inconclusive evidence.

of facts. In wild reverie, for example, there may be ideas passing through the mind which may or may not agree with facts ; but such a chaotic conflux of ideas cannot be called knowledge, since a belief of correspondence is absent. If, in any case, in spite of the belief, there be no actual correspondence between ideas and things, then, instead of knowledge proper, we have what is called *error or mistake.* And when there is such a correspondence, supported by common experience or by improved methods of research, then knowledge amounts to truth. While truth is useful or beneficial, errors and mistakes are injurious and mischievous. "Remember, always remember," says Rousseau, "that ignorance has never done any harm, and that only error is mischievous ; that a man is not led astray by what he does not know, but by what he wrongly fancies that he knows." (*Emile*, Lib., III.) Hence the importance of correcting our errors and mistakes and avoiding them in future by a careful study of the principles which underlie all correct thoughts.

Error implies the absence of such correspondence, inspite of belief in it ;

while truth indicates the correspondence, when supported by common experience or scientific research.

While truth is beneficial, errors are injurious.

Logic aims at removing errors by furnishing tests of truth.

Knowledge or Truth may be either intuitive or inferential. In the one case, we directly apprehend a fact or phenomenon ; while in the other, it is mediately acquired through some other facts or principles supplied to the mind. We directly know, for example, that triangles are three-sided or that the horse before me is a quadruped. I know from immediate experience that the very nature of a triangle involves three sides

Distinction between intuitive and inferential knowledge or truth.

and that the horse before me has four legs. But the knowledge that the interior angles of a triangle are together equal to two right angles, or that all horses are quadrupeds, is mediate or inferential, as it follows from other qualities previously known or from the repeated observation of like instances.

Inferential knowledge is generally symbolical.

Inferential knowledge is generally of a symbolical* character, the relations expressed in language being assumed, instead of being definitely conceived or realized in personal experience. Gotama recognizes, no doubt, no less than four sources of knowledge, *viz.*, perception, inference, comparison, and verbal testimony or reliable authority : प्रत्यक्षानुमानोपमानशब्दाः प्रमाणानि. (*Nyaya System*, I. 3. *Vatsyayana Bhashya*, p. 6.) But comparison and authority evidently indicate only forms of inferential knowledge. Hence we find Kanada reducing the four sources to two, as mentioned above. Doubt and assurance, he says, may be traced to perception and inference : "तयोर्निष्पत्तिः प्रत्यक्षलैङ्गिकाभ्याम्. (*Vaiseshika Aphorisms*, Bk. X, Aph. 3. Gough's Edition, p. 300.)

Gotama recognizes four sources of knowledge ;

but they are really reducible to two *viz.*, intuition and inference. (Kanada.)

* Symbolical knowledge indicates knowledge as embodied in language, but not directly realized in thought. 'Chiliagon is a plane figure of a thousand sides' illustrates, for example, merely symbolical knowledge, for we do not definitely picture in our mind a plane figure of a thousand sides. We accept it as possible. In reading or reasoning we often pass from word to word with but vague reference to their corresponding meanings, and we seldom realize the description or the entire meaning, distinctly in thought. It is only in doubtful cases that we take the trouble of doing so.

It may be mentioned here that we sometimes acquire knowledge not from direct Observation, nor from explicit Inference, but from Authority. From infancy we are learning facts and laws on the testimony of others: we are told by elders and superiors that objects have such and such properties and qualities, that they are characterized by such and such relations and governed by such and such laws. To reject the collective testimony of society in such cases would be the height of folly on the part of an individual. Authority thus often contributes to our knowledge or belief. But we must remember that the testimony of authority should in every possible case be tested by personal observation and reflection. Mere unreflecting acquiescence in the declarations of authority amounts to prejudice and blind faith. The fallacy known as *argumentum ad verecundiam* involves such an erroneous confidence in authority. Knowledge resting on authority is really inferential in character; and its validity in every case depends on the reliability of the authority whence it is derived. Thus, the value of this form of knowledge ultimately rests on the character of the authority which is its source. "Reliance," says Gotama, "is placed on the contents of a statement on the strength of the affirmation of a competent person." What is called tradition or revelation involves an appeal to authority, human or divine. Historic evidence rests to a certain extent on human authority.

Authority is often an important source of knowledge;

but knowledge resting on authority is really inferential in character.

Distinction between formal and material truth: the one is concerned only with self-consistency, while the other with conformity to facts.

Truth, in the strict sense of the term, implies the agreement of thoughts with things. But, as distinguished from nonsense or absurdity, truth is sometimes taken to mean what is simply self-consistent or free from inner contradiction. Thus a golden mountain or a centaur may be taken as true, as it can be pictured in imagination or realized in thought, though not perceptible by means of the senses. This kind of truth is called *formal*, as distinguished from what is actually true and called *material* truth. Thus, what is formally true may or may not be materially true, but what is materially true must be formally true or self-consistent. Similarly what is formally false must be materially false, for what is self-contradictory can never exist in fact. But what is materially false may be formally true; for though something may not be in harmony with facts, yet it may be self-consistent.

Distinction between Formal and Material Logic, or the Logic of Consistency and the Logic of Fact.

The distinction between formal and material truth leads to the distinction between Formal and Material Logic. Formal Logic is concerned only with formal truth or self-consistency, while Material Logic deals with material truth or actual fact. The one, acccrdingly, is known as the Logic of Consistency, and the other, Logic of Fact. In formal logic we do not take into account whether the data are actually true or not; we merely consider whether they are self-consistent or (as in the case of inference) whether they consistently justify any conclusion. If, for example, we argue thus—

All men walk on their heads,
James is a man,
∴ James walks on his head,

the argument must be taken as formally valid, though it is materially false. If we assume that 'all men walk on their heads' and 'James is a man', we cannot consistently deny that 'James walks on his head.' Similarly we may reason—

All fishes are cold-blooded ;
The whales are fishes :
∴ The whales are cold-blooded.

The reasoning is formally correct, for the conclusion is the inevitable result of the data with which we start. If, however, as a matter of fact, whales are not fishes, then the conclusion, though formally correct, is materially false. Similarly, if by observing a few species of snakes as venomous, we conclude that all snakes are so, the reasoning is materially false, for the few instances observed do not justify the universal conclusion, which is due to hasty and incorrect generalization. Deductive Logic aims at formal truth ; and Inductive Logic, at material truth.

Deductive Logic is essentially formal, while Inductive Logic, material.

Truths have also been distinguished into *necessary and contingent.* A necessary truth is due to the very nature of things and is thus immutable in character. It is true in principle and does not depend on the will or power of any being, finite or infinite. It is apprehended by reason at once, without any extraneous help. It rests on its own analysis and is ultimately based on the principles

Distinction between necessary and contingent truth :

the one is true in principle ; and the other, true in fact.

of consistency. Such, for example, are the truths that two and two make four or that two straight lines cannot enclose a space. They cannot possibly be otherwise ; and even omnipotent power cannot be conceived as altering or reversing them. A contingent truth, on the other hand, is due to the *actual* constitution of things and may be supposed to vary with a variation of such constitution. It is true in fact ; and it ultimately rests on the will and power of a Being who has ordained the present constitution of the universe. It is intelligible by reference to experience and is properly understood only with regard to its special character. Such, for example, are the truths that material bodies fall to the ground or that the lily is white. Necessary truths are sometimes described as truths of reason, as distinguished from contingent truths which are called truths of fact.

Other accounts of the distinction; but they are unsatisfactory.

Bain, however, characterizes necessary truth as that which must be true, and contingent truth as that which may or may not be true. "The *necessary*, or what must be true," he writes, "is opposed to the *contingent*, which may or may not be true." (*Mental Science*, p. 182.) But this explanation of Bain is tenable neither grammatically nor logically. Both 'necessary' and 'contingent' qualify 'truth' ; and to explain contingent *truth* as that which may or may not be true is contradiction in terms.

Others, again, describe necessary truth as that

the opposite of which is inconceivable, and contingent truth as that the opposite of which is conceivable. But this distinction also is not tenable. The necessary character of a truth can never be said to be derived from the impotence of our thought: our inability to conceive the reverse can never confer on a truth its necessary character. A truth is not necessary, because its reverse is inconcievable; rather the reverse is inconceivable, because, it is irreversible in its nature.

The end of knowledge is truth, which the human mind tries to determine by certain tests, constituting the basis of logical science.

Truth is the end of all knowledge; and the human mind has not merely a natural tendency to seek truth but also a natural aptitude to determine it by appropriate tests, which in a formulated shape constitute the rules of logical doctrine. "I hold," says Dr. McCosh, "that human intelligence begins with truth, and if it proceeds properly it ends with truth; which may at times be mysterious, but never contradictory; which may be indefinitely enlarged, but cannot be upturned or reversed......... There is to us no one absolute criterion of all truth; but there are tests of the various kinds of truth, both of those with which we start, and of those which we reach in our progress. Of Intuition itself we have tests in self-evidence, necessity, and universality. Of Reasoning we have stringent tests in the forms of the syllogism. By these two combined we can try Demonstration, which consists in a union of intuition and deduction. We have tests, too, of truths reached in physical, in psychological and in his-

torical investigation, by the Collection of Facts. These are to be found in the Canons of Induction and in the Canons of Verification ; which we may confidently expect to be more and more perfected in their formalization and expression as the separate departments of knowledge make progress." *Examination of Mill's Philosophy*, pp. 382—383.)

Thought is essentially general.

§ 4. **Thought and Language.** Thought is to be distinguished from other forms of knowledge by its aspect of generality. Knowledge is illustrated in our cognition of individual objects, abstract qualities, or general relations ; but thought is illustrated only when we represent things in their general features. Knowledge is generic, while thought is specific. "Thought proper," says Mansel, "as distinguished from other facts of consciousness, may be adequately described as the act of knowing or judging of things by means of concepts." Thus, while thought is essentially abstract and conceptual, knowledge may be either perceptual or conceptual, of the concrete or of the abstract.

Thought is necessary to comprehension.

Thought and understanding are closely connected with each other. We understand or comprehend things when we view them in their general

* The term 'thought' is, no doubt, popularly used at times in the generic sense of any cognitive or intellectual exercise. Thus, we are said to have thoughts of absent persons or of future events. But it tends to be used in Logic and Psychology in its specific sense of the apprehension of generality, which seems to be its proper use.

aspects. Even individual objects are understood when they are interpreted by reference to their generic features or class-attributes. I understand, for example, what this object means by reference to the general idea of 'book'. To think is, thus, to employ a general idea, notion, or concept. The relations of consistency or inconsistency which, as we have seen, constitute the proper subject-matter of Logic, involve the operation of thought in a prominent form. As Logic, however, is concerned with the products, and not with the processes of thought (*Vide* Chap. III, § 2), concepts, judgments, and inferences as mental products really constitute the materials of this science.

Logic is concerned with the products of thought—concepts, judgments, and inferences.

The relation of Thought to Language, as indicated above (*Vide* § 1), is very close. Progress in thought is not possible without a corresponding development of language. Ideas can scarcely be retained and compared without certain connected signs. "Language", says Hamilton, "is to the mind precisely what the arch is to the tunnel. The power of thinking and the power of excavation are not dependent on the word in the one case, on the mason-work in the other; but without these subsidiaries, neither process could be carried on beyond its rudimentary commencement. Though, therefore, we allow that every movement forward in language must be determined by an antecedent movement forward in thought; still, unless thought be accompanied at each point of

Thought and language are inter-connected.

its evolution, by a corresponding evolution of language, its furthur development is arrested." (*Lectures on Logic*, I, p. 139.)

§ 5. **Nominalism, Conceptualism, and Realism. Essence.** The very possibility of thought without language is doubted by some writers. It is urged by them that we can never represent general ideas in our mind. These are intelligible to us only by reference to expressions having a general reference. The supporters of this view are known as *Nominalists*. From the nominalistic stand-point individuals alone exist and can be perceived or conceived. If there is anything general, it is the name or term applicable to several members of a class. In the case of 'man' or 'table,' for example, these terms alone are general in as much as they can indifferently be applied to individual objects possessing similar features. What is present before our mind at any time, whether as an actuality or as an idea, is merely an individual object or image. A name alone can serve as a general sign for connecting such individuals. Against this view it is argued by *Conceptualists* that it is possible on the part of the mind to think of general ideas as well as of individual objects or images. In the case of 'man' or 'table,' for example, we represent in our mind the common and essential attributes in which all men or tables agree, apart from any individual peculiarity. It is contended by the supporters of this view that the mind has not only the power to observe

Nominalism implies that the name alone is general,

while Conceptualism means that general ideas can be formed.

individual objects but also that of depicting in imagination the qualities or features common to the members of a class. "Does it not require," writes Locke, "some pains and skill to form the general idea of a triangle? (which is yet none of the most abstract, comprehensive, and difficult;) for it must be neither oblique, nor rectangle, neither equilateral, equicrural, nor scalenon; but all and none of these at once. In effect, it is something imperfect, that cannot exist; an idea wherein some parts of several different and inconsistent ideas are put together." (*Essay on the Human Understanding*, Bk. IV, Chap. VII, § 9.) And Berkeley, as a champion of Nominalism, observes, "I find, indeed, I have indeed a faculty of imagining, or representing to myself, the idea of those *particular things* I have perceived, and of variously compounding and dividing them. I can imagine a man with two heads, or the upper parts of a man joined to the body of a horse. I can consider the hand, the eye, the nose, each by itself abstracted or separated from the rest of the body. But then whatever hand or eye I imagine, it must have some particular shape and colour. Likewise the idea of man that I frame to myself must be either of a white, or a black, or a tawny, a straight, or a crooked, a tall, or a low, or a middle-sized man. I cannot by any effort of thought conceive the *abstract* idea above described." (*Principles of Human Knowledge*, Introduction, § 10.)

Realism affirms the existence of eternal realities which are the fundamental types of creation.

As the controversy of Nominalism and Conceptualism is associated with Realism, let us briefly refer to it here. *Realists* maintain that not only is it possible on the part of the mind to represent general ideas, but there are also objective or actual realities corresponding to them. Thus, when we think of 'man' or 'table,' we understand by it not merely the individual beings or objects illustrating the common attributes of a class, but also an abiding reality which is an embodiment of such attributes. Plato is regarded as the father of Realism. According to him general ideas have extra-mental or real existence, and they serve as models of creation. There is, no doubt, some truth in Realism, in as much as creative plans as archetypal thoughts constitute eternal Types which are perpetually realised in the different forms and grades of being. And such plans may be conceived as objective ideas or eternal verities after Plato.

Essence is the nature of a thing determining its qualities.

In this connection we may notice the meaning of *Essence*. Essence (from Lat., *essentia*, from *esse*, to be) ordinarily implies the extracted qualities which represent in a small compass the virtue or true nature of anything. Thus, we speak of the essence of peppermint or of chiretta. "Essence," says Locke, "may be taken for the being of anything, whereby it is what it is. And thus the real internal (but generally in substances unknown) constitution of things, whereon their discoverable qualities depend, may be called their

'essence'."* (*Essay on the Human Understanding*, Bk. III, Chap. III, § 15.) From the realistic stand-point 'essence,' accordingly, implies the inner nature of a class as determined by the appropriate universal idea or mould in which individuals have been cast. It is called *essence or quiddity*, as it answers the question *quid est hoc* (what is this)? Humanity, for example, is the essence of man, whence all the characteristic attributes of mankind follow. Locke distinguishes between the *real* and the *nominal* essence of a class. Thus, the *nominal* essence of gold is "that abstract complex idea" implying the "properties of colour, weight, fusibility, fixedness, etc.," indicated by the term 'gold'; while the real essence is the "constitution of its insensible parts on which depend all those properties." The nominal essence of natural objects depends, therefore, on the real, which indicates the "unknown constitution of their insensible parts." (*Ibid.*, § 17.) Thus, 'essence', while originally implying the nature of a thing throwing adequate light on its qualities, has gradually come to mean its hidden character—more or less inaccessible to thought. "It is important," says Ferrier, "to remark the change of meaning

From the realistic stand-point, it is the universal idea or type.

Locke's distinction of real and nominal essence.

Change in the meaning of the term.

* In his letter to Stillingfleet Locke takes Essences "to be in everything that *internal constitution*, or frame, or modification of the *Substance*, which God, in His wisdom and good pleasure, thinks fit to give to every particular creature when He gives it a being; and such essences I grant there are in all things that exist."

which this word has undergone in its transmission from the ancient to the modern schools of philosophy. Formerly the word 'essence' meant that part or characteristic of anything which threw an intellectual illumination over all the rest of it......... Now-a-days it means exactly the reverse.........The 'essence' is the point of darkness, the assumed element in all things which is inaccessible to thought or observation." (*Institutes of Metaphysics*, p. 249.) Nominalistic writers take the essences of classes to be "merely the signification of their names." (Mill, *Logic*, I, p. 123.)

From the nominalistic stand-point, 'essence' is but the meaning of a name.

**§ 6. Science and Art. Normative and Practical Science.** Without entering into the Metaphysical question of the real character of universals or essences, we may confine our attention simply to their logical aspect. Logical processes evidently involve the use of names, which are intelligible only by reference to corresponding ideas. Thus, thoughts constitute the very basis of logical doctrine, without which names, or things are quite foreign to us. Thoughts, however, may be either comparatively detached and unconnected, or systematic and harmonious; they may be either vague and incorrect, or definite and valid. Now, when thoughts are valid and systematic, giving rise to a definite department of knowledge characterized by accuracy and precision, we get what is called a *Science*. Popular or empirical knowledge when improved and perfected builds up science. While empirical or everyday knowledge is concerned

Knowledge when becoming general, accurate, and systematic gives rise to Science.

with the individual, science is concerned with the general; while the one is precarious, the other is certain and exact; while the one proceeds without any order or system, the other proceeds methodically or systematically. Science, as Kanad observes, is knowledge "free from imperfection" ( अदुष्ट' विद्या ). [*Vaiseshika Aphorisms*, Bk. IX, ii, 12. Gough's edition, p. 296.] The characteristics of a Science, accordingly, are (1) generality, (2) certainty, (3) accuracy, and (4) system. Let us say a few words with regard to these features.

*Characteristics of Science*:

It is essentially

(1) general

(1). Our every-day knowledge is concerned with the concrete and the individual: we are ordinarily interested in our own home, friends, property, and country, and their peculiarities or distinguishing features. But science is not primarily concerned with individual things or peculiarities; it is interested in general features and relations calculated to throw light on many facts of a kindred nature. Thus, in Physics or Chemistry we are not so much interested in a particular instance of light or heat, or of this or that compound, as in the general features and laws which explain such individual instances. The aim of a science always is to discover the general conditions or laws which underlie a definite class of facts constituting its subject-matter. It tries to generalize knowledge as much as possible. General truths are (*a*) theoretically, as well as (*b*) practically, useful. (*a*) They condense information, relieve memory, and satisfactorily explain seemingly diverse facts by estab-

(and general truths are both theoretically and practically useful),

lishing, as it were, a family relationship among them; (*b*) they alone can safely guide us in our expectations, inferences, and practices. Hence is it that, however much our ordinary interests may centre round individual objects or cases, science is interested in generality.

(2) certain,

(2) Scientific knowledge must always be certain or unquestionable, while common knowledge may often be of a doubtful character. Knowledge when based on facts and resting on rational grounds comes within the province of Science. Mere opinion or prejudice can never constitute scientific knowledge. The end of science being truth, only that form of knowledge can be called scientific the validity of which we are quite sure of.

(3) accurate,

(3) Scientific knowledge must also be accurate and precise; and accuracy and precision can be attained only when knowledge is carefully examined and verified. Thus, science always implies the bestowal of sufficient care and attention on a definite subject to secure the exact correspondence between our ideas and facts. It involves the employment of logical principles and methods to ensure the correctness of thought.

and (4) systematic

(4) Scientific knowledge must further be systematic and methodical. Every science has a definite subject-matter of its own, within the limits of which its facts and principles constitute a systematic whole. Random survey of all facts which happen to come before the mind is not at all conducive to scientific inquiry. To put together, for

example, facts about digestion and facts of our moral life would serve no useful purpose ; it could only perplex and confound the understanding. Division of themes or fields of inquiry is convenient to the human mind and so conducive to the growth of the sciences themselves. Every science has thus a definite province of its own ; and within its province it studies facts in a definite order and in their mutual bearing. It has, as Bain observes, " A certain *order* or arrangement of topics, suitable to its ends in gathering, in verifying, and in communicating knowledge." (*Logic*, I, p. 24.)

Science is concerned with knowledge, while Art with practice.

We have already referred to the distinction between Science and Art in section 2. A Science, as we have seen, is a body of principles explaining a particular subject-matter, while an art is an aggregate of rules subserving a definite end. The one is concerned with knowledge ; the other, with practice. "The language of science," as Mill observes, "is, This is, or This is not ; This does or does not happen. The language of art is, Do this, Avoid that. Science takes cognizance of a phenomenon and endeavours to discover its *law* ; art proposes to itself an *end*, and looks out for means to effect it." (*Essays on Political Economy.*) As ordinarily man acts before he reflects or systematizes, so Art usually precedes Science. Prof. Mackenzie observes, "The art usually includes a great deal that we are not able to reduce to science at all. Indeed, some arts are so entirely dependent on the possession of a peculiar knack or dexterity, or of a peculiar kind

Art ordinarily precedes Science.

of genius, that they can scarcely be said to have any science corresponding to them at all. Thus, for example, there is no science of cookery, there is no science of sleight-of-hand, there is no science of making jokes, and there is no science of poetry." (*Ethics*, p. 12.) *(a)* Art is thus used by some writers in the sense of a sort of knack or dexterity which is not based on an explicit knowledge of principles or laws guiding conduct. *(b)* But, as a matter of fact, we often find Art based on Science : when Art is thus based on an explicit knowledge of principles it is called by some *Scientific Art* or *Practical Science.* (*Vide* Bain's *Logic*, i, p. 29.) "If we insist," writes Mackenzie, "on drawing an absolute distinction between a science and an art, a practical science must be regarded as lying midway between them." (*Ethics*, p. 11.)

Ambiguous use of the term 'Art.'

Art based on Science is called Practical Science or Scientific Art.

Distinction between Science and Art is not absolute.

It may, however, be remarked here that the distinction between Science and Art, or between Theoretical and Practical Science, is rather relative than absolute. As a matter of fact, they generally go together. If, as Bacon says, knowledge is power, we are apt to apply it to practice; and thus Science becomes Art. Again, if an Art is to be certain and useful, it should have a scientific basis. Whewell says, "The principles which art *involves*, science *evolves.* The truths on which art depends lurk in the artist's mind undeveloped, guiding his hand stimulating his invention, balancing his judgment, but not appearing in the form of enunciated propositions. Art in its earlier stages is anterior to science

—it may afterwards borrow aid from it." (*Inductive Science*, ii, p. 111.) It may be added that Art, to be sure and communicable, should be based on Science ; otherwise, an Art is seldom precise and definite. An Art, if not based on a knowledge of the conditions of its practice, is rather an impulse than a procedure ; it is but an inspiration, an insight, a tact. Art, divorced from Science, is blind and precarious ; and Science, divorced from Art, is speculative and idle. An Art, to be sure and successful, must be scientific ; and a Science, to be useful and interesting, must bear fruit in practice. A body of knowledge is called Science, not because there is no reference to practice, but because the theoretic aspect is prominent. Similarly, a procedure of action is called Art, not because it is not based on knowledge, but because the practical aspect is predominant.

Distinction between Practical and Normative Science :

A distinction is drawn at times between a Practical and a Normative Science. It is urged that while the former considers merely the means necessary for the realization of a particular end, the latter inquires into the character of the end itself which serves as the norm, ideal, or standard in a definite sphere of activity. As Prof. Mackenzie observes, "It is the business of a normative Science to define an ideal, not to lay down rules for its attainment." (*Manual of Ethics*, p. 10.) As the end of Logic, however, is not merely the determination of the ideal or standard of truth but also the enunciation of rules by which conformity to the standard can

while a Practical Science determines means for the attainment of a definite end, a Normative Science investigates the character of the end itself, as an ideal of conduct.

Logic is both a normative and practical science.

be secured, Logic is to be viewed both as a normative and practical Science. It investigates the character of the ideal, which we must strive to attain that we may be free from error and fallacy, and at the same time lays down rules by means of which the end may be achieved.

Logic aims at consistency, which is interpreted differently by different classes of logicians :

§ 7. **Schools of Logic.** The end of Logic, as we have seen, is consistency. But there is dispute among logicians as to the precise character of consistency which Logic tries to secure. Realistic, Nominalistic, and Conceptualistic writers thus differ in their views about the proper end of logical doctrine. Let us consider these views one by one.

(1) from the realistic stand-point, consistency of actual relations and correlations ;

1. **The Objective, Realistic, or Material View.** From this stand-point, Logic is direcly concerned with the things as existing and their mutual relations and correlations. That logical relations are implicated in the things themselves is evident, it is urged, from the fact that subjective inferences are borne out by objective connections or issues. If, for example, we know that three-fourths of a particular species of mangoes are sweet, and two-thirds possess a peculiar flavour, then we know, as a matter of fact, that five-twelfths of the mangoes possess both the flavour and sweetness. Similarly, when the keys of a logical machine* are

* Logical machine was first constructed by Jevons in 1869. It has subsequently been improved by Venn and Marquand. The one constructed by Marquand in 1882 is comparatively simple in structure, while admitting more complex relations, involving several terms. A diagram of Jevons' machine is prefixed to his *Principles of Science*.

pressed down according to certain premises, the machine itself shows the conclusion justified by them. All these go to show that the relations and correlations of things, which constitute the subject-matter of logical science, are not merely thought-relations but actual facts.* Spencer, accordingly, defines Logic as the Science which "formulates the most general laws of correlation among existences considered as objective." It "contemplates in its propositions, certain connexions predicated, which are necessarily involved with certain other connexions given; regarding all these connexions as existing in the *non-ego*—not, it may be, under the form in which we know them, but in some form." (*Principles of Psychology*, II, § 302, p. 87.) Lewes also holds an analogous view.

(Spencer's definition of Logic) ;

2. **The Subjective, Conceptualistic, or Formal View.** From this stand-point Logic is concerned only with our thoughts or ideas, whether expressed in language or not. We have to consider in Logic only the relations of consistency or inconsistency existing among our ideas, without any reference to outward facts. In a judgment, *e.g.*, we consider whether there is a relation of consistency or inconsistency between our ideas of the subject and the predicate. When, for instance, we say 'Man is mortal,' we mean that there is a congruous relation between the ideas of humanity and

(2) from the conceptualistic stand-point, consistency of thoughts

* We need not enter here into the question of the ultimate character of reality, which comes within Metaphysics instead of Logic. (*Vide* Chap. iii, § 4)

mortality. Similarly, in a negative judgment we mean an incongruous relation between the concepts standing for the subject and the predicate. Whether actually there are 'men' or there is 'mortality', or there is an actual connection between the two, falls from this stand-point outside the scope of logical inquiry. Formal truth or consistency is thus taken to be the end of Logic. Hamilton and Mansel may be named as the supporters of this view. Hamilton defines Logic as "The science of the Laws of Thought as Thought, or the science of the Formal Laws of Thought, or the science of the Laws of the Form of Thought."

(Hamilton's definition of Logic);

(3) from the nominalistic stand-point, consistency of language.

**3. The Linguistic or Nominalistic View.** From the linguistic or nominalistic stand-point, it is held that Logic is concerned only with terms or language. If there be thoughts or things not expressed in language, they do not come within the province of Logic. Logic considers only terms, propositions, and arguments. Whately may be named as a supporter of this view. "Whereas, in reasoning," observes Whately, "*terms* are liable to be *indistinct*, (*i.e.*, without any clear, determinate meaning,) *propositions* to be *false*, and *arguments inconclusive*, Logic undertakes directly and completely to guard against *this last* defect, and, incidentally, and in a certain degree, against the others, as far as can be done by the *proper use of language*. It is, therefore, (when regarded as an *art*) "The Art of employing language properly for the purpose of Reasoning ; and of distinguish-

(Whately's view.)

ing what is properly and truly an Argument from spurious imitations of it." (*Elements of Logic*, p. 37.)

The nominalistic or linguistic view is untenable by itself:

It may be mentioned in this connection that the linguistic or nominalistic view can never be held alone. Language by itself does not signify anything. Language must stand either for thoughts or for things; and when language is divorced from them, it becomes a mere unmeaning combination of symbols—a jargon. The linguistic view must, therefore, be held either with the subjective or with the objective view, since language expresses either thoughts or things. Thus, while Whately apparently holds the linguistic, he really adopts the formal view of logic*; and while Mill, in his *System of Logic*, apparently maintains the linguistic, he really adopts the material, view.†

it must be held either with the conceptualistic or with the realistic view.

The realistic or objective view must likewise be combined with the conceptualistic or subjective.

It may also be observed here that the objective or material view can scarcely be maintained by itself. Objective qualities or relations by themselves do not constitute the subject-matter of logic. A science is concerned with knowledge;

"If any process of reasoning, says Whately, *can* take place, in the mind, without any employment of language, orally or mentally, (a metaphysical question which I shall not here discuss) such a process does not come within the province of the science here treated of." (*Elements of Logic*, p. 37.)

† "What we do, what passes in our mind, when we affirm or deny two names of one another," observes Mill, "must depend on what they are names of; since it is with reference to that, and not to mere names themselves, that we make the affirmation or denial." (*System of Logic*, I, p. 21.)

and knowledge without reference to a mind becomes unmeaning. A logical machine shows the conclusions following from certain premises because it is the invention of a mind: the machine is, as it were, thought objectified or crystallized. Unless, therefore, we are disposed to identify thought with reality, such as is advocated by Hegel or Lewes, an absolute objective Logic can never be defended. An objective logic can lay claim to existence only by reference to subjective.

The fact is that the subjective or formal view is closely connected with the objective or material.*

'Subject' and 'object' are correlative factors in every case of knowledge. In perceiving, for example, the table before me, the percipient mind is known as the 'subject', while the table perceived is known as the 'object.' Hence '**subjective**' implies mental or what pertains to the mind; and '**objective**,' real or what pertains to the thing known. As we are not concerned in Logic with the metaphysical question of the ultimate character of reality, 'objective,' for logical purposes, may be construed to imply the reality as apprehended by us. As knowledge is always knowledge *of a fact*, the subjective and objective sides are inseparably connected. When there is perfect correspondence between them, there is true or correct knowledge; otherwise there is error or illusion. (*Vide* § 3.)

'**Form**' and '**Matter**' are, likewise, correlative factors illustrated in every case of knowledge. 'Form' is what is constant, while 'matter' is variable. A ball, for example, may be made of rubber, leather, iron, or wood. Thus, though the stuff or matter varies, yet the form (*i.e.*, the quality of being round) remains constant. Similarly, the form of a coin due to the impression of its die is the same, whatever may be the material of which the coin is made. In the case of thought, we observe a like difference. We may think of this, that, or some other object—trees, stones,

Truth, in the proper sense of the term, implies not merely freedom from inner contradiction, but also conformity to facts. Our thoughts, to be strictly true, should be consistent among themselves as well as with facts. Thus, the subjective, objective, and linguistic views are all closely connected with one another, our ideas being expressed in language and representative of facts; perfect subjective consistency finally ensures also due objective and linguistic consistency. All these views, however, are not equally fundamental. The subjective or formal view constitutes the groundwork; and, when liberally construed or duly interpreted, it involves material and linguistic consistency as well. "Instead of regarding Logic as a purely objective science," remarks Dr. Venn, "we might with more propriety term it a science which gives the rules for converting the subjective into the objective." (*Mind*, IV,

Truth properly speaking involves correspondence among thoughts, things, and language;

but it is essentially subjective.

Views of Mill and Venn.

animals, men, or angels—but the way in which we think of them, so long as we think correctly, is invariable. We cannot, for example, realize in any case that an object possesses contradictory qualities—such as red and not-red, or material and immaterial. The laws of thought which determine thinking in every case constitute, as it were, the die or stamp, the impress of which is visible in every object of which we think. But these laws acquire a meaning only by reference to the objects of thought; if there be no definite object or 'matter' of thought, the laws, which constitute the 'form', become unmeaning. Thus, what we call formal truth requires 'matter' for its illustration; and material truth involves also the application of 'form.' And, if we take a teleological view of nature, we naturally expect correspondence and connection between the subjective and objective, the formal and material factors of knowledge.

p. 46.) Even Mill, in his *Examination of Hamilton's Philosophy*, advocates an analogous view, when he takes Logic as "The science of the conditions on which right concepts, judgments, and reasonings depend." (P. 448.)

Logic underlies every science and every reasoned account.

§ **8. Scope of Logic.** Logic has very aptly been described by Duns Scotus as the Science of Sciences and the Art of Arts. As a Science is a reasoned account of a definite subject-matter, the validity of its conclusions ultimately rests on logical principles. Logic is thus the widest of all sciences, as its help is more or less required in every science. In fact, a science is but a special application of the principles of logic to a particular subject-matter; and thus the different sciences are described as different logics.* We see, then, that the scope of logic is very wide, embracing the reasoned account of any and every topic. But though reasonings of all type come within its province, it has nothing to do with the materials themselves. It may, no doubt, lay down and employ definite tests for determining the character and significance of the materials in any case, but beyond estimating their inferential value, it is not directly concerned with them.

It is thus concerned with inferential knowledge.

The sphere of logic is thus restricted to inferential knowledge. Intuitive knowledge, or knowledge based on immediate consciousness, as mentioned above (*Vide* § 1), is not amenable to logical tests

* 'Logic' enters into the very composition of the words representing the different sciences, *e.g.*, geology, mineralogy, physiology, psychology, theology, zoology. (*logy*=logic or science).

and is, therefore, outside the scope of logical science. We have seen that scientific knowledge is essentially general; and logic, being the science of sciences, deals, accordingly, with the most general conditions of all thought. These general conditions, however, can be gathered only by reflective analysis and comparison, and not by direct intuition. Having gathered the general conditions of valid thought, logic proceeds to formulate rules by the application of which we may determine the validity of definite instances of inference and connected processes (such as definition, division, classification, and naming). Logic, therefore, assumes the ultimate principles or axioms of thought on the one hand and the ultimate data or materials on the other, without inquiring into their ulterior character or significance. It merely teaches us how to use the materials according to the axioms or principles so as to promote the end of truth or science.

The axioms and materials are assumed in Logic.

It may be mentioned in this connection that some writers (such as Spencer, Mr. Read) are disposed to hold that logic is concerned only with qualitative propositions, as distinguished from quantitative ones, which constitute the proper subject-matter of mathematics. Logic and mathematics are thus regarded as co-ordinate sciences; and Mr. Read, accordingly, defines logic as "The science of proof with respect to *qualitative* laws and propositions, except those that are axiomatic." (*Logic*, p. 2.) It may be observed, however, that this view is scarcely tenable. In mathe-

Logic and Mathematics are viewed as co-ordinate by Spencer and Mr. Read;

(Mr. Read's definition of Logic).

but Logic is really superior to Mathematics, since Mathematical reasoning, to be valid, must be logical.

matics we have also to reason; and, if we are to reason correctly, we must reason according to the principles of consistency constituting the basis of logical science. Logic as the most comprehensive science thus examines all propositions, whether quantitative or qualitative, with a view to determine their validity and evidentiary value.

Logic is concerned with mental products—concepts, judgments, and inferences.

Logic, it should be remembered, is concerned with mental products and not with mental processes, which come within the province of psychology (*Vide* Chap. III, §2.) And the mental products, which constitute the subject-matter of logical doctrine, are concepts, judgments, and inferences, together with such subsidiary processes as definition, division, and classification. We shall refer to the different parts more fully in § 15.

Logic, though primarily concerned with thoughts, is secondarily concerned with things and language.

Again, Logic, though primarily concerned with the mental products, is secondarily concerned also with things and language. We have seen that thoughts, things, and expressions are inseparably connected with one another; so that, to secure truth, in the full sense of the term, we must be consistent with the world as well as in our thoughts and language. Logic, thus, directly deals with thoughts, and indirectly with things and expressions so far as they contribute to the validity of the former.

Logic is usually divided into Inductive and Deductive, treating of

## § 9. Inductive and Deductive Logic.

Logic has usually been divided into two main parts, *viz.*, Inductive and Deductive: the one is concerned with Inductive Inference, while the

other, with Deductive. Inductive Inference differs from Deductive in two essential features:

the corresponding forms of inference.

*Points of difference between Inductive and Deductive Inference:*

(1) In Inductive Inference, the conclusion is more general, while in Deductive Inference, it is not more general than the data or premises.

(1) In Inductive Inference we proceed from less general to more general truths, while in Deductive Inference our conclusions are never more general than the data. All general propositions, except those that are axiomatic or self-evident, are derived by inductive reasoning from particular instances observed; while deduction consists in extending the application of these general propositions to new cases. Observing, for example, in several instances that the function of the heart is to keep up the free circulation of the blood, we conclude that this is its function in every case, so that wherever we may find the heart we may presume its function to be analogous. Likewise, noticing and learning that men have hitherto died, we conclude generally that men are mortal, so that wherever we subsequently observe the human constitution we anticipate also its mortality as an inseparable adjunct. Though Deduction thus ordinarily supplements Induction in our concrete inferences, yet, for scientific convenience, the two forms of inference are studied separately with a view to the discovery of their appropriate functions and tests.

(2) Induction aims at material, while Deduction, at formal, truth.

(2) The other important point of difference between Induction and Deduction lies in the fact that the one aims at material truth, while the other, at formal. In order that our generalizations may be of any value, they must be based on facts; and

hence the importance of well-regulated observation and experiment in inductive inquiry. Deduction, on the other hand, accepts these inductive generalizations and proceeds to draw legitimate consequences from them. Thus, Deduction is marked by formal or subjective consistency: assuming the data to be true, it merely considers the inferences which inevitably follow from them.

Inductive Logic, besides expounding the conditions of Inductive Inference, discusses also other connected logical processes, such as Hypothesis, Explanation, Definition, Classification, and Naming. Deductive Logic, likewise, explains not merely the conditions of Deductive Inference but also the connected processes of Division and Definition.

**§ 10. Inductive and Deductive Sciences.** Corresponding to the distinction between Induction and Deduction, there is the distinction between the Inductive and Deductive Sciences.

Induction and Deduction often combine to satisfactorily establish a truth.

To satisfactorily establish a truth, we often have recourse, no doubt, to both inductive and deductive principles. Inductive generalizations are thus verified, whenever possible, by deductive application of higher laws; and deductive conclusions also are often tested by empirical generalizations and scientific research. "Combined Induction and Deduction expresses," as Bain observes, "the full force of scientific method for resolving the greatest complications." (*Induction*, p. 102.)

Some sciences, however, are

Though Induction and Deduction are, thus, closely connected with each other, and most of the

sciences really make use of the principles of both, yet we find that in some sciences Induction plays a prominent part, while in other sciences Deduction is prominently illustrated. In Pure Mathematics, for example, we find deduction prominently illustrated ; and Mixed Mathematics is also to a great extent deductive. Mathematical truths are generally deductions from principles previously accepted. If the Mathematical Sciences are thus deductive, we find the Physical Sciences to be generally inductive in character. In the physical sciences we try to discover laws by means of observation and experiment ; and generalizations are reached by means of the Inductive Canons. It may be mentioned in this connection that there are certain sciences in which processes subsidiary to Induction, such as classification, are prominently illustrated. Classification, for example, is prominently illustrated in Botany and Mineralogy. Of course Definition, either of the deductive or inductive form, is illustrated more or less in all the sciences to explain fundamental notions.

more inductive, while others, more deductive ;

The *course of scientific progress* may generally be described as a transition from Induction to Deduction. In the infancy of a science, facts, constituting its subject-matter, are carefully studied ; and then laws are generalized by the application of the Inductive Canons. The progress of a science means the discovery of several general laws, and laws which are more and more general. Thus the laws, which, in the earlier stages of the progress of a

and generally the course of scientific progress is from induction to deduction.

science, are merely empirical, become derivative *in the later stages of its development.* As a science becomes more and more complete and perfect, it tends to be more and more deductive. The laws and principles previously established are now applied to new cases to justify certain conclusions. In Astronomy, for example, we find this aspect well illustrated.

Logic is a science of proof instead of discovery.

§ **11. Discovery and Proof.** Logic is more a science of proof than of discovery. Discovery is generally due to imaginative insight, divining the probable explanation of certain facts or phenomena. To explain them, different hypotheses may be started by different individuals ; but only those are accepted as legitimate which can stand the test of logic. The main business of logic is thus to supply a set of rules or tests by means of which we can examine the correctness of our guesses, opinions, and views. In the case of Induction, for example, we may be led hastily to generalize a proposition or suppose a causal connection between phenomena which invariably go together ; but whether such a generalization or supposition is correct or incorrect can be determined only by the application of the Inductive Canons. Similarly, in the case of Deduction, we may draw conclusions not justified by data ; and we can be sure of the correctness or incorrectness of such inferences only when we apply to them the rules and principles of deductive reasoning. We may, for example, argue that because

Discovery is ordinarily due to hypotheses or guesses, which are tested by logical canons or rules.

all tables have legs, and all horses have legs, therefore all tables are horses; or we may suppose comets to be the causes of disaster by observing their frequent conjunction. Whether, however, we are right or wrong in our suppositions, can be settled only by logical tests, deductive and inductive. "Of the two ends [Discovery and Proof]," says Bain, "the logician has most to do with the second; Proof is his main object, for which he can lay down definite laws; Discovery is a valuable end, likewise, but it is not equally amenable to prescribed rules." (*Induction*, p. 96.) Mill, therefore, very appropriately defines Logic as "The science of the operations of the understanding which are subservient to the estimation of evidence." (*Logic*. I, p. 11.)

Mill's definition of Logic supports this view.

§ **12. Proof and Demonstration.** Proof implies the adducing of evidence to produce belief in favour of or against a view or position. There are thus degrees of proof corresponding to the different degrees of conviction produced by it. Proof, accordingly, is a generic term, while Demonstration indicates a special form of it. Demonstration is proof from first principles, which are so self-evident in character as to leave no room for doubt about the conclusion. Thus, we speak of the demonstrations of Euclid, which ultimately rest on axioms and difinitions as self-evident and analytical propositions. "In all demonstrations," observes Aristotle, "the first principles, the conclusion, and all the intermediate propositions

Proof generally implies the adducing of evidence to establish a fact.

Demonstration is proof from axioms or first principles.

must be necessary, general, and eternal truths; for, of things fortuitous, contingent, or mutable, or of individual things, there is no domonstration." Hence demonstration is essentially deductive in character. It tries to connect a truth with a first principle and so to show that the truth is as indisputable as the principle itself. Inductive generalizations, as ultimately resting on contingent experience, can never amount to that certainty which demonstration secures. Such generalizations may admit of increase or modification by further research or inquiry, while demonstrative truths are fixed and immutable. Within the limits of experience, however, there are degrees of certainty corresponding to the varying probative force of evidence adduced. Our conviction may range from very weak probability to perfect assurance. "To conform our language more to common use", says Hume, "we ought to divide arguments into demonstrations, proofs, and probabilities. By proofs we mean such arguments from experience as leave no room for doubt or opposition." (*Inquiry*, sec, 6, notes.) The term Proof is thus occasionally used in a specific sense as contradistinguished from the clearest conviction produced by Demonstration.

It is essentially deductive, certain, and perfect.

Induction, on the other hand, is more or less imperfect and contingent.

Proof is sometimes used in the specific sense of valid argument based on experience.

Demonstration is either direct or indirect, according as it establishes a truth by at once showing it to be contained in some self-evident proposition, or it proves a truth in a round-about way by showing that its opposite is quite untenable, being

Demonstration is either direct or indirect.

self-contradictory. Hence Indirect Reduction is known as *demonstratio per impossibile* or *deductio ad absurdum.* The indirect or negative form of demonstration should be resorted to only when the direct or positive form fails. Instances of the two forms of demonstration may be found in Euclid as well as in the Reduction of Syllogisms. (*Vide* Chap. XI, § 15.)

§ **13. Uses of Logic.** The utility of the study of logic is illustrated both (1) subjectively and (2) objectively: it improves the mind and contributes at the same time to the development of the sciences. Let us consider these two uses separately.

I. *Subjective Utility.* The study of Logic (1) strengthens the understanding

**I. Subjective Utility.** (1) Logical study is a form of severe mental discipline; and so it constitutes an important part of liberal education. The true end of education is the due cultivation of mental powers. Such cultivation requires that our faculties should be exercised logically and methodically for the attainment of truth and the avoidance of error. Logic, as concerned with the general principles of valid thought, is evidently fitted to develop the power of abstract thinking. The valid application of logical principles tends to strengthen the understanding, which lies at the root of all study and all culture.

and (2) favours the due comprehension of subjects.

(2) The due comprehension of topics and subjects and their systematic treatment and exposition can be effected only when they are studied and explained in logical fullness and consecution.

Inadequate or irregular study of facts or principles is neither conducive to mental culture nor favourable to the aquisition of knowledge itself. Logical training prepares the way for a thorough study and adequate comprehension of any subject-matter.

II. *Objective Utility:*

II. **Objective Utility.** The objective utility of logic is illustrated no less (1) with regard to the ordinary facts of experience than (2) with reference to scientific knowledge. (3) It is illustrated also in our dealings with men.

Such study (1) helps an adequate explanation of facts,

(1) Facts are adequately interpreted only when they are considered in all their logical bearings and connections. If we merely notice facts as they are presented, without analysing them and discovering their general conditions, then we can but imperfectly understand their character or significance; and our estimate of them in such a case is more or less imperfect and precarious. Moreover, it is not possible for us to remember the multitudinous individual facts without any reference to their general conditions. The discovery of these conditions by logical analysis and the interpretation of them by logical principles help their due comprehension and prepare the way for science. Without logic there can at most be imperfect empirical knowledge.

(2) promotes the cause of truth and science,

(2) The utility of logic is no less patent in the study of the Sciences. Every science involves reasoning, more or less, and so it illustrates the application of logical principles. To distinguish between

valid and invalid thought and to expose the error underlying the latter, we must have an explicit knowledge of the principles which guide all valid thinking. Pakshila Swami, accordingly, describes Logic as "The light of all science, the means of all effective work, and the secure foundation of all virtue and religion."

and (3) enables us successfully to influence and convince others.

(3) We are required in daily life to deal with others and to persuade or convince them. This end is eminently secured by Logic. We may, no doubt, persuade or dissuade others by appealing to their passions or sentiments or by employing sophistries of various kinds. But the most honourable and successful method of convincing and persuading others is a clear, methodical, and correct form of argument. And we must remember that the logical form of persuasion is the most wholesome and abiding in its results. Though the logical principles are such as are ordinarily observed by men when they think correctly, yet a study of logical science gives an explicit and clear knowledge of them — thereby enabling individuals to avoid confusion and fallacy. This, no doubt, is an immense gain. One who has not studied logic may apply unawares the principles of correct thinking to concrete cases; but he may also commit fallacies, for he has not a clear knowledge of the principles and the possible errors arising from their violation. An individual, on the other hand, who has carefully studied logical doctrine, has a thorough grasp of the principles to be observed

in correct thinking ; and thus he has a clear view of the snares of fallacy to be avoided by scrupulous adherence to the laws of thought. As the study of Hygiene may lead people to observe more carefully the laws of health and thus to be healthy and strong, so the study of Logic not infrequently leads them to observe with care the laws of thought and thus to be free, to a great extent, from error and confusion. Systematic logical discipline alone can enable one to detect errors and fallacies, which generally lie below the surface, and thus to reach truth and secure accuracy.

"Errors, like straws, upon the surface flow ;
He who would search for pearls must dive below."
(*Dryden.*)

§ **14. Origin of Logic**. In the absence of a definite, authentic record, the question of age is always very difficult to decide, specially when the parents are dead. And it is extremely difficult in the case of a science like Logic, which is practically as old as human thought itself. It would be beyond the scope of this elementary treatise to enter into a full discussion of the history of logical doctrine. It is, however, generally admitted that among the ancient nations only two, namely, the Greeks and the Hindus, conceived Logic and Grammar as deserving separate treatment like the other sciences. The Romans in this respect were indebted to the Greeks, and the Germans to the Romans. Similarly, the Arabs borrowed these sciences from the Greeks, and the Jews from

The Greeks and Hindus first conceived Logic as a science.

the Arabs. If, however, the question is still pressed as to which of the two nations—the Greeks and the Hindus—conceived Logic first, the balance of evidence seems to be in favour of the latter. Even if we accept the modest estimate of Mr. Bodas, we find that the Sutras of Gotama and Kanada are referred to the fifth or fourth century B.C. And we know that Aristotle lectured in the Lyceum from 335 to 323 B.C. Thus, the priority of Indian Logic can scarcely be questioned. But this does not necessarily prove that the Greeks obtained their Logic from the Hindus. If the general conditions of sound thinking be the same in all, it is no wonder that great thinkers of different ages and countries may independently discover them and thus lay the foundation of logical science in their own way. If independent discoveries be possible in other sciences, they are almost inevitable in the sciences of the mind. The close resemblance, however, between the Greek and Indian Logic (both having their categories, genus, species, and syllogisms) has led some to maintain that the Greek Logic was derived from the Indian. And Gorres has tried to show that the Greeks had actually borrowed certain terms from Sanskrit. It is not unlikely that Alexander the Great, who took so much interest in the scientific pursuits of his beloved preceptor,* should have sent him copies

Indian Logic seems to be older.

* It is said that, to encourage Aristotle in his Zoological investigations, Alexander supplied him with 800 talents and employed more than a thousand men in his Asiatic expedition to collect, preserve, and transmit animals of various species and kinds.

of Indian Logic for his perusal; and the views of Aristotle might have thus been modified to a certain extent. This may explain the parallelism in the treatment of the subject, without making one dependent on the other.

Inductive Logic was founded by Roger Bacon, improved by Francis Bacon, and subsequently systematized, by J. S. Mill.

We may take Roger Bacon, the Franciscan friar (1214—1294), as the founder of Inductive Logic, which has subsequently been improved by Francis Bacon, Lord Verulum (1561—1626), and systematized and formulated by J. S. Mill (1806—1873). But whatever may be the history or form of logical doctrine, its aim has always been to secure consistency—consistency among thoughts, consistency with dogma, or consistency with things. " "Bring your thoughts into harmony one with another," was the demand of Aristotle's age. "Bring your thoughts into harmony with authority," was the demand of the Middle Ages. "Bring them into harmony with fact," was the requirement most keenly felt in more recent times." (Minto, *Logic*, p. 14.)

The aim of Logic has always been to secure consistency.

§ **15. Scope of This Work: Distribution of Topics.** Without entering into minute details, this elementary work aims at explaining the general principles and rules which underlie the principal logical processes required either for scientific pursuit or for the ordinary experience of common life. Every man is, no doubt, a born logician. What Logic wants to achieve is to render explicit the principles which implicitly operate in the human mind, and thus to enable individuals

This work aims at explaining general principles and rules of Logic.

to avoid error and confusion and attain to truth and science.

This work is divided into six Books, the first of which is Introductory, explaining the character of logical science, the fundamental principles on which it is based, and the relation in which it stands to the other sciences. Book II is devoted to the exposition of Deduction, in its three Divisions of Terms, Propositions, and Inferences. Book III explains the character and conditions of Induction (Division I), together with the processes which are Aids to it (Division II) and the Results achieved by it (Division III). Book IV treats of the Accessories of Inference in general, such as Definition, Division, Classification, and Nomenclature. Book V gives an account of Method ; and Book VI explains the character, forms, and sources of Fallacies.

It is divided into six Books :
Book I is Introductory.

Book II explains Deduction ; and

Book III, Induction.

Book IV treats of Accessories of Inference ;

Book V, of Method ; and Book VI, of Fallacies.

# CHAPTER II.

## Fundamental Principles of Logic.

Belief is essential to knowledge.

**§ 1. Credence Essential to Knowledge and Science.** We have seen that knowledge ultimately rests on belief, so that if we commence with absolute scepticism, there can properly be no experience at all. (*Vide* Chapter I, § 3, foot-note.) If we doubt the testimony of the senses or of consciousness, we cannot proceed a single step; and since infancy we are more or less dependent on the testimonies of others. If a child be conceived as beginning with universal doubt, his life would be at stake, which would preclude the possibility of all experience or knowledge. Any extravagant attempt at verification, such as was illustrated in Berkeley when he wanted to feel how persons hanged are affected at the time of execution, is ordinarily treated as inconsistent with sanity or good sense.

Absolute scepticism is suicidal.

It may be said, however, that, whatever may be the tendency in common life, science should always be based on clear knowledge derived from personal experience. But, as every science is a special inquiry into this or that department of knowledge, it cannot possibly inquire into all the conditions or circumstances necessary to elucidate even its own subject-matter. Thus, Geometry

Even science rests on assumptions.

assumes the existence of space and the possibility of its being bounded in various ways, as well as the axioms and postulates necessary to prove its problems and theorems. Mechanics, likewise, assumes the existence of forces and their operation in various ways, which are amenable to calculation and explanation. Similarly, Chemistry assumes elements and the possibility of their combination in various compounds ; and Optics assumes light and its diverse modifications under different circumstances. All these sciences assume, moreover, the existence of observing minds that can examine facts and elucidate them by reference to general principles. To adequately explain a fact, we must trace its relation to all the other facts of this universe, which would require an omniscient intelligence. We are, accordingly, constrained to restrict our inquiry ; and what is assumed in one science may be explained in another. Thus, mathematical principles are assumed in Physics, while physical principles are assumed in Mathematics. The science which inquires into the character of ultimate principles is known as Metaphysics. (*Vide* Chapter III, § 4.)

Logic, therefore, assumes the axioms or principles, according to which we are to reason.

Logic, as the science of sciences, undertakes to explain the ways in which we should investigate facts and reason about them in order to attain truth. It thus assumes facts which we are to observe and the ultimate laws and principles according to which we are to reason about them. The data or materials of thought are supplied by

observation and the special sciences, while the general principles of thinking are supplied by Psychology and Metaphysics. As the matter of thought is multifarious in character, it would be idle to enumerate or systematize its contents. We shall, accordingly, confine our attention, in the present chapter, to the exposition of the forms of thought, *viz.*, the fundamental principles which underlie all valid thought and which Logic borrows from Metaphysics and Psychology to attain its own end—truth. Let us consider in a separate section the character of these fundamental principles, which are taken to be axiomatic or self-evident in their nature.

§ 2. **Character of Axioms or Fundamental Principles of Thought.** It is a matter of dispute among logicians and psychologists whether these axioms or principles are derived from experience or they are the inborn conditions of all experience. It is maintained, on the one side, that they are mere generalizations from uncontradicted experience, so that neither the senses nor the imagination can present facts contrary to them. We never perceive, nor can we conceive, that a thing is other than what it is, or that an event is uncaused or quite capricious in character. The Laws of Contradiction, Causation, and Uniformity of Nature are thus taken as self-evident or axiomatic because their contraries have never been experienced.

The axioms or fundamental principles are taken by some as generalizations from uniform experience;

It is contended, on the other side, that they are

while they are viewed by others as the inborn conditions of all knowledge and experience.

the inborn conditions of all knowledge and experience and that the very possibility of thought presupposes their operation. They are necessary truths admitting of no variation, doubt, or proof; they are as patent in the first case as after a thousand cases have been judged, and they are understood as soon as they are stated. Their necessary, self-evident, and universal character irresistibly point to the fact that they are anterior to all experience, which must in every case be conditioned by them. The first principles, as Gotama says, are like the light of a lamp (न प्रदीपप्रकाशवत् तत्सिद्धेः, २।१९); they are immediately apprehended, and can never be proved.

The controversy however, is rather psychological than logical.

We may only mention here that the controversy is rather a psychological than a logical one, though it has been brought into the arena of logical debate by enthusiastic logicians having a psychological bias. When we remember that logic is concerned with mental products and not with mental processes and that the aim of logic is the attainment of truth and not the discovery of the origin of this or that form of knowledge, we see that the controversy is properly outside the province of logical science. Whatever account may be given of the fundamental principles, it cannot be denied that they are binding upon all thought, and that a thought which is not based on them defeats itself. No doubt, this primitive necessity betrays that these axioms or laws are inherent in our mental constitution, predetermining the ways

The fundamental principles are binding upon all thought.

in which we must think, if we are to think correctly; but, as we have said, we are concerned in logic, not with the origin of the principles or laws and the ways in which we actually think, but with the mental products and the conditions which secure their validity as elements of truth.

Avoiding controversy, we shall treat here of six Fundamental Principles.

**§ 3. The Fundamental Principles of Logic.** The fundamental principles of logic, on which all logical operations are ultimately based, are those elementary truths which underlie all thought and which, if transgressed, would render thought impossible. Opinions differ as to their exact number and scope; but, avoiding the controversial aspect, we shall attempt here an explanation of those that are generally accepted by logicians. The Fundamental Principles are—(1) The Law of Identity, (2) the Law of Contradiction, (3) the Law of Excluded Middle, (4) the Law of Uniformity of Nature, (5) the Law of Causation, and (6) the Law of Sufficient Reason. Let us explain these Principles one by one.

(1) The Law of Identity: a thing is identical with itself.

**§ 4. (1) The Principle, Law, or Axiom of Identity.** A thing is what it is; A is A or A = A. It means that the data of logic are absolutely fixed. If we have taken a certain thought as having certain contents, our subsequent treatment of it must be determined by our assumption. If we have taken 'man' to mean a certain class of individuals possessing the qualities of susceptibility to pleasure and pain, capability of locomotion, and reason, we must not subsequently take it to indi-

cate a different group of individuals or qualities. No doubt, we may afterwards use the word in a different sense, but only as a different term, though clothed in the same garb or expressed by the same symbol. The materials of logic are subject to no change: time has no place in it. Though actually things may possess certain qualities for a time and may lose them afterwards, yet in logic we never take any notice of such changes, which take place in the actual world. The data are regarded as unalterably fixed; and we must abide by our assumption. As Parmenides says, "One must affirm and believe that that which is, is." Mill takes the principle as implying—"Whatever is true in one form of words, is true in every other form of words which conveys the same meaning." (*Examination of Hamilton's Philosophy*, Third Edition, p. 466.)

The data of logic are unalterably fixed.

From this principle of Identity there follows what Hamilton calls "*The Postulate of Logic*"—"That before dealing with a judgment or reasoning expressed in language, the import of its terms should be fully understood; in other words, Logic postulates to be allowed to state explicitly in language all that is implicitly contained in thought." (*Lectures*, III, p. 114.) The import of this postulate is that so long as the thought expressed by a term remains the same, it is immaterial what verbal changes we make in it for the sake of scientific convenience. The identity of thought being preserved, we may make necessary changes

The Postulate of Logic is but an aspect of Identity.

in its embodiment, the expression. In describing the logical characters of terms and propositions, or in testing arguments, we frequently require the help of this postulate to make requisite verbal changes, retaining the thought unfolded by them as the same.

So is the Principle of Similarity.

*The Principle of Similarity* underlying all inference is also but an aspect of the Law of Identity. From mere difference we can never infer anything. If A be unlike B, and B unlike C, we cannot infer whether A is like or unlike C. What we call similarity is due, however, to the identity of some quality. Cats, for example, are like tigers, because there are certain qualities common to both (*e. g.*, both are quadrupeds having peculiar claws and teeth and a strong predaceous instinct gratified by stealthy and sudden attack). As Aristotle observes, "Similarity is unity in some quality, while identity is unity of essence." (*Metaphysics*, IV, 15, 1.) Broadly speaking, we may describe similarity as imperfect identity (*i. e.* identity in some feature or features), while identity is perfect similarity (*i. e.*, similarity in essence, entity, or existence). Compare Jevons' Theory of the *Substitution of Similars.**

* "The one supreme rule of inference consists," says Jevons, "in the direction to affirm of anything whatever is known of its like, equal or equivalent. *Substitution of Similars* is a phrase which seems aptly to express the capacity of mutual replacement existing in any two objects which are like or equivalent to a sufficient degree." (*Principles of Science*, p. 17.)

The Principle of Similarity is thus only a form of Identity. Whenever we infer anything from certain data, we do so only on the ground of essential similarity between the evidence and the conclusion. We can never infer, for example, the mortality of John from the mortality of man, if there be no essential similarity between John and man. Similarly, the conclusion 'All men are mortal' from 'John is mortal, 'James is mortal, 'Brown is mortal,' rests on the essential similarity between 'men' on the one hand and 'John, 'James' and 'Brown' on the other. No inference is possible without an essential similarity. If things were incessantly to change their nature, there would be no room for inference or expectation.

(2) The Law of Contradiction: a thing can never possess two hostile or contradictory qualities.

§ 5. (2) **The Principle, Law, or Axiom of Contradiction.** A thing cannot both be and not be; it cannot possess two contradictory attributes at the same time and in the same sense. An individual, A, cannot be both B and not-B; if it is B, it cannot be not-B; and if it is not-B, it cannot be B. Of two contradictory opposites, if one be true of an individual, the other must be false of it: both cannot at the same time and in the same sense be true. As Mill says, "The affirmation of any assertion and the denial of its contradictory are logical equivalents, which it is allowable and indispensable to make use of as mutually convertible." (*Examination*, pp. 471-472.) If James is good, he cannot at the same time be

not-good; and if he is not-good, he cannot at the same time be good: the truth of one implies the falsity of the other. No doubt, being good he may afterwards become not-good, or *vice versa*; or, we may use 'good' and 'not-good' in different senses, so that both may be applicable to him at the same time; but the two terms, as contradictory opposites, cannot at the same time and in the same sense be both true of James. Sir W. Hamilton regards this principle (which he calls the Law of Non-contradiction, since it enjoins "The absence of contradiction as an indispensable condition of thought") as equally primary with that of Identity, the one being the positive and the other the negative expression of the same law. (*Lect.* III, pp. 81-82.)

(3) The Law of Excluded Middle: a thing must possess either of two contradictory qualities.

§ 6. (3) **The Principle, Law, or Axiom of Excluded Middle.** Everything is either a given thing or something other than the given thing; it must possess one of two contradictory qualities. Two contradictory terms, like good and not-good, red and not-red, are so related that, taken together, they exhaust the whole universe of thought and existence. There is no intermediate sphere between two contradictory terms, where an individual object may find its lodging. If an individual be excluded from one class, it must be included in the other, for any intermediate possibility between them is excluded. An individual, A, must, therefore, be either B or not-B; it cannot be neither. An individual object must be either 'red' or 'not-red.' Two contradictory

attributes can never be false of one and the same thing at the same time and in the same sense: the falsity of one implies the truth of the other. As Mill says, "The doctrine of Excluded Middle empowers us to substitute for the denial of either of two contradictory propositions the assertion of the other." (*Examination*, p. 473.) If the individual, A, be not B, it must be not-B; and if it be not not-B, it must be B. If a piece of chalk be not white, it must be not-white; and if it be not not-white, it must be white. The Principles of Contradiction and Excluded Middle were first formulated and explained by Aristotle in his Metaphysics.

The Laws of Identity, Contradiction, and Excluded Middle are but different aspects of one truth.

According to the Principle of Identity, a thing is what it is: "Any notion contained in a subject can become the predicate of it." According to the Principle of Contradiction, two attributes, related to each other as contradictory opposites, cannot be simultaneously *true* of an individual in the same sense,—one of them must be false; while, according to the Principle of Excluded Middle, both cannot be *false* of it,—one of them must be true. These three principles or laws can never be isolated; they are really implicated in one another, being but different aspects of the same mental necessity. Assimilation and discrimination being the characteristics of thought, every product of thought must bear on it their impress: we know an object to be what it is, as distinguished from what it is not.

It may be mentioned in this connection that two contradictory terms, B and not-B, can both be neither true nor false of an *individual* thing. If we take a general notion or class, as 'man', we find that two contradictory attributes, as 'civilized' and 'not-civilized' may both be true of it, in one sense, and false, in another : both true, as 'some men are civilized' and 'some men are not-civilized'; both false, as 'all men are civilized' and 'all men are not-civilized.' When we take a class, and predicate something of it, then the two contradictory propositions are of the forms—'no men are civilized' and 'some men are civilized', or 'all men are civilized' and 'some men are not civilized', both of which can simultaneously be neither false nor true in the same sense.

(4) The Law of Uniformity of Nature : Nature is uniform in her ways.

§ 7. (4) **The Law of Uniformity of Nature.** This implies that Nature is uniform in her operation : the same cause under the same circumstances gives rise to the same effect. Inspite of the diversity of experience, the universal conviction of mankind is that Nature is uniform in her ways. It is illustrated in our expectations, habits, and customs. Life would have been intolerable had Nature been capricious in her conduct : we could not then count upon the qualities of things, their relation to one another and to ourselves. This law is the ground of all inductive generalizations. "The fact, generally expressed in Nature's Uniformity", observes Bain, "is the guarantee, the ultimate major premise, of all Induc-

It is the basis of all inductive generalizations.

tion. 'What has been, will be,' justifies the inference that water will assuage thirst in after times. We can give no reason, or evidence, for this uniformity; and, therefore, the course seems to be to adopt this as the finishing postulate." (*Logic*, I, p. 273.)

The Law of Uniformity may also be taken as but an aspect of the Law of Identity. To say that Nature is uniform in her ways, is to hold that her operation is the same or identical under the same or identical circumstances. We can never realize that the circumstances remaining exactly the same, the effect can possibly be otherwise than what we have noticed. "The primitive tendency of the mind", says Bain, "is to believe, until checked, that what is now will continue, that what is here is the same everywhere. Neither experience nor any intellectual faculty creates this impetus, but experience arrests and modifies it, till by degrees it adapts itself to the real occurrences." (*Ibid.*, p. 226.)

The Law of Uniformity may be regarded as but an aspect of Identity.

§ **8**. (5) **The Law of Causation**. It implies that every event has a cause, that every change is due to an agency that has produced it. The essence of the law of causation lies in the necessary connection existing between the prior phenomenon, viewed as cause, and the posterior phenomenon, viewed as effect. For logical and scientific purposes, we may consider only this aspect of necessity and invariability, without entering into the question of the ultimate character

(5) The Law of Causation: every event must have an adequate cause; it implies necessary and invariable connection between what is called the cause and what is viewed as the effect.

of cause or effect.* Mill writes, "The Law of Causation, the recognition of which is the main pillar of inductive science, is but the familiar truth, that invariability of succession is found by observation to obtain between every fact in nature and some other fact which has preceded it; independently of all consideration respecting the ultimate mode of production of phenomena, and of every other question regarding the nature of "Things in themselves."...........To certain facts, certain facts always do, and, as we believe, will continue to, succeed. The invariable antecedent is termed the cause; the invariable consequent, the effect. And the universality of the law of causation consists in this, that every consequent is connected in this manner with some particular antecedent or set of antecedents. Let the fact be what it may, if it has begun to exist, it was preceded by some fact or facts, with which it is invariably connected. For every event there exists some combination of objects or events, some given concurrence of circumstances, positive or negative, the occurrence of which is always followed by that phenomenon. We may not have found out what this concurrence of circumstances may be; but we never doubt that there is such a one, and that it never occurs without having the phenomenon in question as its effect or consequence. On the universality of this truth depends the possibility of

* For a discussion of the subject the student is referred to *The Elements of Morals*, Chap. xx, § 5.

reducing the inductive process to rules." (*System of Logic*, I, pp. 359-360.) We shall consider more fully the characteristics of the Cause in Chapter XVII.

§ **9.** (6) **The Law of Sufficient Reason.** This principle was first enunciated by Leibniz, who states it thus : "Whatever exists or is true must have a sufficient reason why the thing or proposition should be as it is and not otherwise." This Principle has a twofold importance in Logic. (1) It implies that whenever any event happens, it must have an adequate cause to account for it. It thus takes the place of causation and becomes the ground of all inductive inquiry. (2 It implies also that every notion, judgment, or inference must have an adequate ground for its being so and not otherwise. Thus, a concept should not contain any attribute not found in the individuals composing the class ; the affirmation or denial in a judgment should be based on consistency or inconsistency between the constituent notions and facts ; and an inference should be warranted by its data or premises.

(6) The Law of Sufficient Reason : nothing can exist or be true without a sufficient reason.

Its double importance.

*The Principle of Ground and Consequent*—that there is an essential connection between a thing and its attribute, between, say, gold and weight—is but an aspect of the Principle of Sufficient Reason. An adequate explanation of an attribute or quality is found only when it is referred to the nature or essence of the thing, to which it belongs. Without such a necessary connection there could possibly be no inference. This Principle may be

The Principle of Ground and Consequent is but an aspect of Sufficient Reason.

applied in establishing either (*a*) truths of co-existence (*e.g.*, geometrical relations) or (*b*) truths of succession (*e.g.*, qualitative relations).

Jevons axioms.

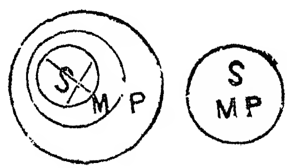
§ **10. Some Subordinate Axioms.** Some Logicians add some minor Axioms to those mentioned above. Jevons, for example, mentions the two following laws which underlie all syllogistic inference :—

"(1) Two terms agreeing with one and the same third term agree with each other.

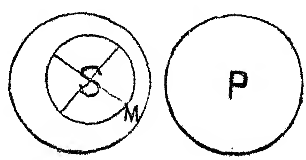
(2) Two terms of which one agrees and the other does not agree with one and the same third term, do not agree with each other." (*Lessons in Logic*, p. 121.)

They are but deductions from Identity and Contradiction.

These two laws follow, however, immediately from the Laws of Identity and Contradiction explained above. (1) The first law is but an aspect of Identity as may be represented by the following diagrams. Here S and P coincide with a third M by a common portion, *viz.*, that represented by S (*i.e.*, the crossed portion). It follows, accordingly, that S and P coincide with each other by that common portion. That is, All S = P, or Some P = S.




(2) The second law is similarly but the joint product of Identity and Contradiction. It may be illustrated by diagrams thus : Here S coincides, and P does not coincide,



with M by some common portion, *viz.*, that represented by S (*i.e.*, the crossed portion). Hence we find that S and P do not coincide with each other by that portion. That is, No S is P, or No P is S. In the one case, we find that S and P, being identical with a portion or whole of M, are identical with each other, so far as the common portion is concerned. In the other case, we find that S is included in M, while P is excluded from it, by some common portion (*i.e.*, the crossed portion); and so we conclude that S and P exclude each other by that portion. The consistency or inconsistency of a relation between S and P is inferred from similar relations existing between S, M, and P.

The Canons of syllogism are also so deducible.

These subordinate laws are included in the *Dictum de omini et nullo* (*i.e.*, statement concerning all and none) of Aristotle, which means that whatever is predicated of a term distributed, whether affirmatively or negatively, may be predicated in like manner of everything contained in it. The other canons of syllogism as laid down by Lambert, Thomson, and other logicians are also deducible from the Laws of Thought given above.

The mathematical axioms, too, finally rest on the Laws of Thought.

The Mathematical Axioms also, though often separately treated, ultimately rest on the above Laws of Thought.

**§ 11. The Principles are Expressions of Identity or Consistency.** Of the above principles the first three, often called the Laws of Thought, are ordinarily regarded as the Principles of Formal Truth, *i.e.*, of Consistency or Deduction,

while the fourth and the fifth are taken to be the Grounds of Real Truth or Induction. The Principle of Sufficient Reason is connected both with Deduction and Induction. As a matter of fact, however, we find that all the Principles or Laws explained above are expressions of Consistency or Identity. We have seen that the Law of Uniformity is really the expression of Identity as found in Nature. And the Law of Causation also rests on the same Principle. When we trace an event to a cause, we mean all events of a like character are due to the same agency. All these events are thus grouped together and interpreted by reference to one and the same law of causation. The same cause accounts for the same effect; and one law weaves them together in every case. And when Causation is traced to Conservation of Energy, the Law of Identity is more palpably illustrated: one and the same form of energy is manifested in different forms under different circumstances. The Principle of Sufficient Reason, likewise, aims at connecting effects with causes, or conclusions with data, and thus establishing an intelligible relation among them by proving them to be parts of a consistent whole. And we have already said that Identity, Contradiction, and Excluded Middle are merely different expressions of the same truth, *viz.*, Identity or Consistency. If a thing is what it is, then evidently it is not what it is not; and it can never be excluded alike from both of these possibilities. That Identity is really

All the Laws or Principles are traceable to Consistency or Identity.

the basal element is evident from the fact that the primitive judgments of children are all affirmative, which are subsequently supplemented by negative estimates by way of distinction.* The Axioms of Identity and Contradiction are combined by Ueberweg in a single principle, called by him the Principle of Contradictory Disjunction. The formula is, "A is either B or is not B. Any predicate in question either belongs or does not belong to any subject; or—of judgments opposed as contradictories to each other, the one is true and the other false." (*System of Logic*, p. 275.) To connect, to unite, to render consistent what is known is the inevitable tendency of the human mind. And the removal of contradictions, the exclusion of errors, is an important means for the attainment of this end. Thus, the remark of Hegel that "Error or other-being, when superseded, is still a necessary dynamic element of truth" (*Logic*, Wallace's Translation, p. 352) has a good deal of truth in it.

That Identity is the cardinal principle is proved by the priority of affirmative judgments.

The removal of contradiction is a means to the attainment of truth.

The Fundamental Principles of Logic lie, as mentioned above, at the very root of all valid thought. No thought is possible without them;

Sully writes, "The father remarks that C.'s sister had had a similar trick of opposing statements, *e.g.*, "Dat E.'s cup, not mama's cup." He then proceeds to observe in his somewhat heavy didactic manner that these facts are of curious psychological and logical interest, showing us that negation follows affirmation, and can at first only be carried out by a direct mental confronting of an affirmation." (*Studies of Childhood*, p. 443.)

The laws of thought are also the laws of things and of correct expression.

and any attempt to transgress them ends only in intellectual suicide. As thoughts and things and expressions are closely connected with one another, the laws of thought are also the laws of things and of correct expression. Both teleology and biology tend to support such a view. Hence, Mill's statement of the axioms, from the nominalistic standpoint, is as much valid as their realistic interpretation by Ueberweg, or their conceptualistic interpretation by Hamilton and Mansel. The mental recoil from contradiction, "the subjective feeling of necessity," as Sigwart calls it (*Logic*, I, p. 15), lies at the bottom of all truth or knowledge. Truth, finally, is unity, harmony, consistency.

> "'Twixt truth and error there's this difference known,
> Error is fruitful, truth is only one."
>
> (*Herrick.*)

# CHAPTER III.

## LOGIC AND THE SCIENCES.

**§1. Place of Logic among the Sciences.** Logic, as we have seen, is superior to every other science, in as much as logical principles are required in every investigation. In every science we are required to define, classify, and reason; and these we can scarcely expect to perform aright without an explicit knowledge of the logical principles and their due application to the subject-matter in hand.

Logic is at the root of every science:

Hence, Logic has been described as the science of sciences. If we classify the sciences in order of generality, they would stand thus: (1) Logic, (2) Mathematics, (3) Mechanics, (4) Physics, (5) Chemistry, (6) Biology, (7) Psychology, and (8) Sociology. In this enumeration, the science which precedes is more general than what follows. Logic is thus the most general science; and next to it we have Mathematics, because the principles of quantity are, more or less, applicable to every science. Mechanics, as the science of force and motion, is next in point of generality. Physics, as the science of molecular movements and relations of material bodies, is wider than Chemistry which treats of the special form of molecular movements illustrated in chemical combination and decomposition. Biology, as the science of life, illustrates chemical properties, but goes to explain the special

Logic is "the science of sciences."

form of them illustrated in living organisms. Sociology is the most complex science, illustrating in it the principles of the other sciences.

Logic is specially connected with Psychology, Grammar, and Metaphysics.

Besides the general relation of Logic to the other sciences, it stands in a special relation to some, with which it is very closely connected. Of these sciences we may mention three, *viz.*, Psychology, Grammar, and Metaphysics.

Logic and Psychology are interconnected;

§ 2. **Logic and Psychology.** Logic and Psychology are to a certain extent interdependent. On the one hand, Psychology requires the help of Logic for its scientific procedure. But, on the other hand, Logic requires the help of Psychology for the discovery and formulation of the laws of valid thought. A knowledge of laws, essential to the attainment of truth, can be acquired only by a careful examination of the facts of consciousness. But, in spite of this close connection, there are important points of difference between them, which are—

but there are also important points of difference between them.

*The points of difference* are: (1) Psychology is wider than Logic.

(1) The province of Psychology is wider than that of Logic. Psychology as the science of mind inquires into all mental phenomena—intellectual, emotional, and volitional. But Logic has nothing to do with emotional and volitional factors. Our pleasures and pains and voluntary activities never come within the province of Logic. Even within the sphere of intelligence, we find that the province of Logic is more restricted. We have seen that Logic has nothing to do with immediate knowledge. Perception, memory, and imagination, though in-

cluded within the province of Psychology, are outside the scope of Logic. Logic has nothing to do with percepts and images; its sphere of inquiry is restricted to the department of general thought—concepts, judgments, and reasonings. Thus, Psychology has a wider sphere of inquiry than Logic.

(2) Psychology is concerned with mental processes, while Logic with mental products.

(2) Psychology is concerned with the mental *processes*, while Logic with the mental *products*. In Psychology, we try to determine the way in which we actually do think on any occasion. But Logic has nothing to do with an inquiry into the character of mental processes. It considers only the result or product of our mental exercise. We do not consider, for example, in Logic how we actually arrive at a concept, judgment, or reasoning, which is a psychological inquiry. But when a concept, judgment, or reasoning is arrived at, the result or product comes within the sphere of Logic. Thus, concepts, judgments, and reasonings, and not the corresponding mental processes, come within the province of Logic.

(3) Psychology is a theoretical and positive science, while Logic is practical and normative.

(3) Psychology is a *theoretical* and *positive* science, while Logic is a *practical* and *normative* science. A theoretical science is concerned merely with the acquisition of knowledge, without any necessary reference to action. A positive science examines the facts as they are given, without any inquiry into an ideal or end. A practical science, on the other hand, is concerned with the attainment of a desirable end, for which it lays down definite rules. A practical science is considered

as normative when the end is conceived as an ideal standard, such as is done in Logic, Ethics, and Æsthetics. (*Vide* Chapter I, § 6.) In Psychology we merely examine the actual facts of our conscious life, without any reference to an ideal or desirable end. No rules are laid down for conformity to a standard or attainment of a definite end. In Logic, on the other hand, an examination of actual facts is not the primary end. It aims at the attainment of an ideal, *viz.*, truth. It lays down rules for the attainment of truth and avoidance of error.

(4) The contents of Logic are more abstract, characterized by intellectual quality alone while those of Psychology are more concrete, being tinged with elements of feeling and volition as well.

(4) We find, even with regard to the province which is common to both the sciences, that the significance of the materials is not the same. Concepts, judgments, and reasonings in Psychology always involve elements of feeling and willing, however faint. But in Logic these intellectual products are altogether divorced from their natural emotional and volitional concomitants. A judgment, *e. g.*, implies in Psychology not merely a relation between two ideas, but also the feeling of pleasure or pain and volitional factors connected with it. A judgment without such natural accompaniments is a psychical impossibility. A judgment in Logic, however, merely expresses a relation between two concepts and nothing more. Thus, the contents of Logic are more abstract, while those of Psychology are more concrete.

(5) Belief, which underlies every judgment more or less, has not exactly the same significance

in Logic and Psychology. The actual grounds of belief in any case may be reason, blind feeling, or strong active tendency. Thus, an astronomer by calculation believes that there will be a solar eclipse on a certain day; a fond mother believes that a hearty meal will benefit her invalid son; and a Captain Webb believes that he will be able to cross the Falls of the Niagara. Psychology as a positive science inquiries into the grounds of all these beliefs, some of which amount merely to prejudice or blind impetuosity. Logic, on the other hand, examines only the rational grounds of belief. Belief in Logic is always considered by reference to proof or evidence, which must be adequate to render it legitimate.

(5) Belief, involved in a jugdment, is measured differently in Logic and Psychology: in the one, it rests only on proof, while in the other, on diverse factors.

§ 3. **Logic and Grammar.** Logic and Grammar are very closely connected. And this connection is due to the intimate relation in which language stands to thought. (*Vide* Chapter I, § 1 and § 4.) If the natural tendency of thought is to issue in expression or language, then Logic, which is primarily concerned with thought, naturally leads to Grammar, which is primarily concerned with language. Again, if language can have a meaning only by reference to thought, Grammar can have a scientific value only when it rests on Logic. If the rules of Grammar be such as require combinations of words not implying any sense, then, instead of being a science, it turns out to be illusory and misleading. We find, accordingly, that all the rules of Grammar,

Logic and Grammar are closely connected, owing to the intimate relation of thought to language.

The rules of Grammar ultimately rest on Logic.

whether of syntax or of figures of speech, aim at perspicuity and consistency.

Grammar, however, is primarily concerned with the correctness of expression, while Logic, with the validity of thought.

Though Logic and Grammar are thus closely connected, yet their aim and scope are not quite the same. The one primarily aims at the correctness and consistency of thought, while the other at the precision and clearness of expression ; the one examines thought-relations, while the other word-combinations. The units of Logic are, therefore, elementary ideas or notions, which can be combined in judgments and reasonings ; but the units of Grammar are letters and syllables, which by themselves can scarcely be said to have any sense. Grammar is not concerned about the truth or falsity of our statements ; it is sufficient if they convey a meaning, whether correct or incorrect. Our reasonings, similarly, may be quite inconclusive though expressed with strict grammatical propriety. Grammar primarily aims at the communication of thoughts in correct forms of expression, so as to render them intelligible to others ; while Logic aims at rendering thought itself valid in order that truth may be attained. Logic may be said to be the back-bone of Grammar. They are complementary branches of study, furthering the cause of truth and knowledge.

Their units or elements do not exactly coincide.

Logic is the backbone of Grammar.

Metaphysics as the science of ultimate reality is distinct from Logic, which

§ 4. **Logic and Metaphysics.** Metaphysics or Ontology is the science which inquires into the character of ulterior realities. Thus, we find that the province of Logic is entirely different

from that of Metaphysics. In Logic we have to do with both the form and the matter of thought. In the case of reasoning, for example, there are the laws of thought, which must be observed in every case, if we are to reason correctly. These laws indicate the 'form' of thought. Again, when we reason, we must reason about something, such as 'tables', 'chairs', 'men,' or 'angels'; and these materials constitute the 'matter' of thought. Logic does not inquire into the real character of either the form or the matter of thought. The principles and materials are merely assumed. An inquiry into their real character comes within the province of Metaphysics. We see, then, that the two sciences are distinct.

is the science of correct thought.

The materials and laws of thought are assumed in Logic, but discussed in Metaphysics.

In spite of this difference, we find that they are connected. If Metaphysics is a science, it must be based on logical principles. Logic as the science of sciences regulates our reasonings in Metaphysics no less than in the other sciences. And Logic, too, depends on Metaphysics for the truth of the fundamental principles and materials. The principles and materials of Logic are not examined in Logic, but are accepted as the result of metaphysical inquiry. The data of Logic are generally supplied by the other sciences; but an inquiry into the ultimate character of these data comes within the province of Metaphysics.

Metaphysics as a science rests on Logic;

and Logic also depends on Metaphysics for the ultimate validity of principles and materials.

It may be mentioned in this connection that idealistic thinkers are disposed at times to identify Logic with Metaphysics. Hegel, for example,

Idealistic writers are at times disposed to identify

Logic with Metaphysics. (Hegel.)

regards the universe as but the evolution of the Infinite Reason ; and thus the laws of thought, according to him, are the laws of Being. (See *The Elements of Morals*, Chapter XII, § 6.)

§ 5. **Exercises.**

1. Define Logic and indicate its province.

2. Examine the different definitions of Logic and support the one which seems to you to be the best.

3. Explain the distinction between *formal* and *material* logic, stating the end aimed at by each. Which department of logic is essentially *formal*, and which *material*, and why ?

4. How is Logic related (1) to the sciences generally and (2) to Psychology in particular ?

5. Logic has been defined as 'the science of the Formal Laws of Thought' : explain what is meant by 'Thought' and 'Formal Laws of Thought'. Do you consider this definition adequate ? If not, substitute what you consider to be a better one, giving your reasons.

6. Distinguish Deductive from Inductive Logic, and point out the relation of both to Logic.

7. Logic has been called 'the Science of Sciences.' Why ? Indicate the uses of the study of Logic.

8. What is Knowledge ? Explain the difference between Immediate and Mediate Knowledge, giving examples. How is it possible to advance from the former to the latter ? When you go out in the morning, and find the roads in a muddy condition, you believe at once that there has been rain during the night : explain what is *immediate* and what is *mediate* in your knowledge of this subject, giving your reasons.

9. Explain the meaning of (*a*) the word 'Principle,' and (*b*) the phrase 'Principles of Logic.' State what you take to be the Fundamental Principles of Logic, and explain their meaning clearly.

10. State and illustrate fully the Principles of Identity

and Contradiction, exhibiting their relation to each other. Explain and illustrate their use and significance as principles of reasoning.

11. Distinguish between the Form and the Matter of Reasoning, and between Formal and Material Logic. From what sources does thought obtain materials for its reasoning?

12. What do you mean by Truth? Distinguish between (1) formal and material truth, (2) mediate and immediate truth, and (3) necessary and contingent truth.

13. Distinguish Knowledge from Thought, and point out the relation of Thought to Language.

14. Distinguish Realism, Nominalism, and Conceptualism, and point out their bearing on logical doctrine.

15. Is Proof or Discovery the end of Logic? Distinguish between (1) Proof and Demonstration, and (2) Direct and Indirect Demonstration.

16. Distinguish between Science and Art. Determine their conditions and relative priority. Is Logic a Science or an Art?

17. Distinguish between Normative and Practical Science. Is Logic a Normative or a Practical Science?

18. Distinguish between Inductive and Deductive Sciences, and determine the course of scientific progress.

19. Point out the importance and place of the Fundamental Principles of Logical Science. Do they constitute the subject-matter of logical inquiry?

20. Point out the uses of the Postulate of Logic and the Principle of Sufficient Reason in Deductive Logic.

21. What do you mean by Essence? Distinguish between Real and Nominal Essence.

22. Give a brief account of the different Schools of Logic. To which School do you belong?

23. Point out the relation of Knowledge to Belief. Is the logical ground of Belief the same as the psychological ?

24. Explain the Laws of Causation and Uniformity of Nature, and point out their relation to each other.

25. Logic is said to be 'The science and art of consistency.' Examine the definition in the light of the history and the different forms of logical inquiry ?

# BOOK II.

## DEDUCTION.

## DIVISION I.

## TERMS.

## CHAPTER IV.

### IMPORT OF TERMS.

§ 1. **Preliminary.** We have seen that Logic is concerned with inferential, and not with intuitive, truth. (*Vide* Chap. I, § 1 and § 8.) Though inference is thus the principal subject-matter of logical doctrine, yet there are other topics which come within its province. Inference is a complex mental product, involving judgments or propositions, and concepts or terms. For example, when we examine the inference—All men are mortal, Kings are men, therefore Kings are mortal—we find that it is composed of three judgments or propositions, one of which, *viz.*, the last, is the conclusion, and the other two the data or premises. Each of these judgments or propositions is made up of concepts or terms. For example, the proposition, 'all men are mortal' is composed of two terms 'men' and 'mortal,' connected together by the link or copula 'are.' A proposition is thus composed of two terms; and, as a proposition is the expression in language of a judgment, a judgment when analyzed betrays

Logic is chiefly concerned with Inference.

Inferences are made up of Propositions; and Propositions, of Terms.

the presence of two concepts corresponding to the terms in a proposition. To understand fully the character of inference we must previously have an adequate knowledge of its constituent parts, namely propositions and terms. As we can expect to learn a language only by a previous study of its alphabets, syllables, words, and their combinations, so in Logic we can expect to understand the character of inference by a previous study of its constituent parts—propositions and terms. Logical doctrine may, accordingly, be divided into three parts, *viz.*, (*i*) the part on Terms (Division I), (*ii*) the part on Propositions (Division II), and (*iii*) the part on Inferences (Division III). Of these three parts, the part on Terms is the most elementary and the part on Inferences, the most complex. We shall, accordingly, commence with the study of Terms and end with the study of Inferences.

Hence Logic is divided into three parts—Terms, Propositions, and Inferences.

Words are wider than terms.

§ 2. **Words and Terms.** Before we come to the study of terms, let us distinguish them from words. All words are not terms, though all terms are words or combinations of them. By a term we are to understand an expression conveying a definite sense, which may become either the subject or the predicate of a proposition[1]. In the sentence or proposition 'man is mortal,' the

[1] Subject in a proposition or sentence is that of which something is said, while predicate is that which is said of something else. In the proposition, 'horses are quadrupeds' the term 'horses' is subject and the term 'quadrupeds' is predicate.

words 'man' and 'mortal' are terms. They are called terms, because they form the extremities (from Latin *terminus*, an end or extremity) of the proposition. Every word, however, cannot be so used. Articles, adverbs, prepositions, conjunctions, interjections, for example, can never by themselves be used either as the subject or as the predicate of a proposition. These words alone can never become terms or the extremities of propositions. We may, no doubt, form such propositions as—'of' is a preposition, 'and' is a conjunction; but in these sentences 'of' and 'and' are used as substantives and not as a preposition or a conjunction. Hence such words cannot, properly speaking, be called terms. Only those words that by themselves can stand as the subject or as the predicate of propositions can be called terms. Words, therefore, are wider than terms. Words have been divided, for logical purposes, into two classes, *viz.*, *categorematic* and *syncategorematic*. Categorematic (from Gr. *kategorema*, a predicate) words are terms, while syncategorematic (from *syn*, with, and *kategorema*) words are those words which are not terms. They can be terms only when joined to categorematic words.

Words are divided into categorematic and syncategorematic. Categorematic words are terms.

**§ 3. Import of Terms.** The word 'term' has been used, at least, in two different senses: (1) in a wide sense 'term' stands for a word or a combination of words which *may be* used as the subject or as the predicate of a proposition. For example, the expressions (*i*) 'The table before me',

'Term' is used in two senses:

(1) in a wide sense, it indicates a word or a combination of words

which *may be* used as the subject or the predicate of a proposition

(*ii*) 'round' are terms in as much as they may be employed either as the subject or as the predicate of a proposition. For example, we may construct propositions with the given expressions thus: 'The table before me is rectangular', 'the ink-stand is round.' (2) In a narrow sense 'term' implies an expression which *is actually* used as the subject or as the predicate of a proposition. In this strict sense, the expressions, "the table before me' and 'round' cannot be regarded as terms, for they are not parts of a sentence or proposition.

(2) In a narrow sense, it is a word or a combination of words *actually* so used.

In a wide sense a term is a name.

A term in the wider sense is thus a name, standing for any object of thought, real or imaginary, mental or material, substantive or attributive. Thus, 'man,' 'horse,' 'mermaid', 'spirit', 'feeling', 'iron', 'excellent', are all terms or names implying either things or qualities. "A name," says Hobbes, "is a word taken at pleasure to serve for a mark, which may raise in our mind a thought like to some thought we had before, and which being pronounced to others, may be to them a sign of what thought the speaker had before in his mind." (*Computation or Logic*, Chap. II.) A name or term thus stands for a concept or an idea.

Hobbes' definition of a name or term.

Concept or Notion is a general idea suggested by a term.

A Concept or General Notion is our idea of the common and essential attributes of a class. It is the product of comparing several objects and is the result of abstraction and generalization. It refers not to things or qualities themselves, but to our idea of the class. For example, the concept 'man' refers to our idea or notion of the common and

essential qualities of the class, man – *viz.*, animality (covering sentiency and capability of locomotion) and rationality—and not to the human beings composing the class, nor to the attributes themselves as existing in them. The symbol, helping the retention and reproduction of the concept and suggesting it to others under ordinary circumstances, is the *term* 'man.'

How concepts are formed.

The formation of a concept implies (1) observation of several individual objects, (2) analysis of every one of them into its component qualities, (3) comparison of the several qualities of one object with those of other objects with a view to find out the common features and reject the individual peculiarities, (4) detection of the points of similarity and considering them as a single group or whole, and (5) finally associating a word or expression with the product, *i.e.*, naming it, in order to retain and reproduce it in future and communicate it to others. To form, for example, the concept 'library,' we are to observe several libraries, find out the attributes present in each, and then (after comparing them and turning our attention away from their individual peculiarities) gather the common and essential qualities which constitute together the concept, symbolized and expressed by the term 'library.'*

* The process explained here should not be supposed to be the actual process as it takes place in the infant mind when forming a concept. We are concerned here with the logical analysis of the process involved in adult consciousness and not with the

Concepts as general representations should be distinguished from Ideas which are representations of all things —general or individual.

Concepts should be distinguished from Ideas. The former stand for general representations of classes, while the latter express all representations whatever, whether general or individual. We may speak, for example, of the concept, notion, or idea of man, horse, or table ; of the idea of this man or of that table, but not of its concept or notion.

Ueberweg's distinction between individual and general conception

Ueberweg, no doubt, uses concept or conception as synonymous with idea. Accordingly, he distinguishes between Individual and General Conception. "A conception," he writes, "may be either an *individual conception* or *intuition*, which has to do with one individual (or with what belongs to one individual), or a *general conception*, which refers to a mutually-related group of individuals (or of what belongs to individuals), and forms the approximate mental (psychic) basis for the notion." (*System of Logic*, p. 110.)

is not tenable.

But, to avoid confusion of language, it is better to use 'Idea' as the generic name for any representation, whether of individuals or classes, and to reserve 'Concept' or 'Notion' as the specific name for our idea of a class.

An Idea expressed in language is a Term.

An idea or notion expressed in language is a Term or Name.

Objectively, a Term indicates an individual or a class, a quality or a group of qualities.

Objectively or realistically interpreted, a term indicates either an individual or a class, a quality or an aggregate of qualities. Thus, 'John' refers to a particular individual, while 'man,' to a class.

psychological history of Conception. Psychologically viewed, a concept is a complex product due to a great extent to the influence of Social Intelligence on the Individual Mind. Concepts are thus formed by a series of judgments.

Similarly, 'hardness' indicates a single quality, while 'civilization' stands for a group of qualities. In the case of a general term we find that it directly indicates the several members of the class, constituting what is called its denotation, and it indirectly implies the common and essential qualities found in such members constituting what is called its connotation. The importance of this topic requires a separate treatment; and so let us consider it in a different section.

A general term has both a denotation and a connotation.

§ 4. **The Denotation and Connotation of Terms.** When we closely examine the meanings of terms we find that generally they have two senses. This is specially the case with general terms. The term 'man', for example, indicates in the first instance the individual human beings to every one of whom the name is applicable in the same sense. Thus, 'man' stands for John, Smith, Brown, Mohamed, &c., *i.e.*, all persons known as human beings. These individuals indicated by the term constitute its **denotation, extension, scope, or breadth**. But the term 'man' implies at the same time the common and essential attributes, such as 'animality' and 'rationality' found in all men. The term 'man' is applied to different individuals, not arbitrarily, but by reason of their possession of certain essential features which constitute what we call the very meaning of the term. Thus, the common and essential attributes present in all the individuals, forming the denotation of a term, constitute its **connotation, inten-**

Denotation indicates individuals,

while connotation, their common and essential attributes.

**sion, comprehension, or depth.** We find, then, that denotation refers to the individuals expressed by a term, while connotation implies the common and essential attributes possessed by them.

Connotation may be taken subjectively, objectively, or conventionally. In Logic the last is the proper sense.

The connotation of a term may be taken subjectively, objectively, or conventionally. Subjectively, connotation depends on the information of an individual; objectively, on the qualities actually existing in things; and conventionally, on the essential attributes determined by scientific research. In Logic we are concerned only with the conventional or scientific connotation, the subjective form coming within the province of Psychology, and the objective, within that of Metaphysics. As mentioned above, Logic is concerned not with the actual processes of thinking, nor with the things as actually existing independently of the mind, but with the things as properly construed by thought. Thus, the connotation in Logic is taken to be fixed, as settled by scientific investigations. It may be modified by further research; but it does not depend on the accidents of personal information. The connotation of a term is determined not by all the features common to the individuals constituting its denotation, but by the essential and fundamental attributes. In the case of whales, for example, the possession of warm blood is a far more important attribute than the mere possession of fins or living in water. By an essential or important attribute we mean an attribute which by its presence determines the presence of many other

attributes. Warm blood, for instance, involves the qualities of breathing air, being viviparous, and suckling the young; while the mere possession of fins or living in water means but little. Similarly, in the case of 'man,' the attributes of rationality and animality are far more important, from which many other qualities follow, than the bare possession of hair, a nose, or twenty fingers.

Inverse variation of denotation and connotation.

Examination reveals that the denotation (Lat. *de*, down, and *noto*, to mark) and the connotation (Lat. *con*, with, and *noto*, to mark) of a term vary inversely: if one increases, the other decreases; and if one decreases, the other increases. If, for example, we take into account the denotation of the term 'table,' we find that it indicates all the tables found in the world. If, however, we increase the denotation by including other things (such as chairs and benches) in the class 'table,' then the connotation evidently decreases. For the denotation of the term thus widened covers other articles of furniture; and all of them do not possess the peculiar attributes of table. Similarly, if the denotation be further widened, and we take into consideration not merely furniture but all material bodies, then the connotation is further diminished, for all material bodies do not possess the qualities of furniture. We see, then, that as we go on increasing the denotation of a term, its connotation decreases. Likewise, if we increase the connotation, the denotation is diminished. If, for example, we increase the

connotation of 'table' by taking into consideration, a particular form, say, 'round,' then the connotation increases; for the qualities of round table are evidently greater than those of table. But we find at the same time that the denotation diminishes. The denotation of round table is evidently less than that of table. If we increase the connotation still more by taking into consideration round, marble tables, then we find that the denotation still more diminishes; for all round tables are not made of marble. We see, then, that the denotation and the connotation of a term are so related that if one be increased, the other would be diminished.

But this rule is not always true.

It may similarly be shown that if the connotation or denotation of a term decreases, then the denotation or connotation increases. Suppose, we decrease the denotation of 'man' by taking into consideration only good men. Now, we find that the connotation increases in as much as goodness is added to the common attributes of man or humanity. Similarly, if the connotation decreases the denotation increases. Thus, the connotation and the denotation of a term vary inversely.

The relation of denotation to connotation, as explained above, though generally true, is not always found to be so. When, with the increase of knowledge or by accident, the connotation or the denotation of a term is increased or decreased, then the other remains unaffected. When, for example, by further examination and research we

discover a new quality of gold, hitherto unknown, then the connotation of 'gold' increases ; but the denotation remains the same. The newly discovered quality is found in all the pieces of gold ; and so the denotation is not affected. Likewise, the connotation of gold may diminish when an attribute hitherto considered as essential to gold is found to be but an accidental feature. Thus, though the connotation in such a case may diminish, yet the denotation remains the same, in as much as the subtracted quality is found to be absent from all the lumps of gold. It may similarly be proved that if the denotation be modified by accident, the connotation remains unaffected. If, for example, by earthquake a few islands be brought into existence, then the denotation of island would evidently increase ; but the connotation would remain the same. Similarly, some islands may be totally destroyed. Though the denotation of island would diminish in such a case, the connotation would remain the same.

§ 5. **Relation of Terms Considered in Denotation and Connotation.** Two or more terms may be so related that the denotation of one may include that of another : the term of wide denotation is known as **genus** in relation to the term of narrow extent which is called **species**. For example, the term 'animal' includes the term 'man' in denotation. Thus the term 'animal' is known as genus in relation to the term 'man.' It

Meanings of 'Genus,' 'Species',

should be remembered in this connexion that the terms 'genus' and 'species' are entirely relative, so that a term which is a genus in relation to another may be a species in relation to a third term. The term 'animal', for example, though a genus in relation to 'man', is a species in relation to 'living things'.

'Co-ordinate Species',

'Super-ordinate Term',

'Summum Genus',

'Infima Species,'

'Subaltern Genera and Species,'

'Proximate Genus and Species',

When two or more classes are included in the same genus they are called **Co-ordinate species** in relation to one another. The genus in relation to its species is called **super-ordinate.** The highest genus which can no longer be regarded as a species is known as **summum genus**; and the lowest species which can no longer be divided into classes is called **infima species.** The intermediate classes between the *infima species and summum genus* are known as **subaltern genera and species** in relation to one another. The nearest genus and species to a term are known as **proximate genus and species.** The term 'thing' or 'substance,' for example, may be regarded as summum genus; the term 'man', which stands for the lowest natural class containing individuals, as infima species; and the intermediate classes, such as 'material body', 'living being,' 'animal,' as subaltern genera and species in relation to one another. 'Animal' and 'man' may be viewed as proximate genus and species in relation to each other; and 'man' and 'brute' may be regarded as co-ordinate species coming under the same genus 'animal.' The relation of these terms is well indicated in

the following table, known as the *Tree of Porphyry*:

Substance

Corporeal = Material Body — Incorporeal.

Animate = Living Being — Inanimate.

Sensible = Animal — Insensible.

Rational = Man — Irrational.
(composed of individual human beings).

When we examine the connotation of a genus and of its species we find that the connotation of a species is greater than that of its genus. For example, the connotation of 'animal' is susceptibility to pleasure and pain and capability of locomotion, while the connotation of 'man' includes these attributes as well as the presence of reason. Thus, the connotation of the species 'man' is greater than that of its genus 'animal'. We see, then, that if species is included in genus when taken in denotation, genus is included in species when taken in connotation. It may be mentioned in this connexion that the attribute which marks out a species from its genus or from other species coming under the same genus is called **differentia**. **and 'Differentia.'**
In the case of the terms 'animal' and 'man,' for

example, the attribute of rationality is the differentia of 'man,' as it distinguishes 'man' from its genus 'animal' and also from other co-ordinate species, such as 'brutes.' The distinguishing quality may sometimes be composed of more than one attribute; for example, in the case of a circle the attributes which constitute its differentia are that it is bounded by one line and that its radii are equal.

**§ 6. Terms Related by Way of Contrast or Antithesis.** Besides the relation of inclusion among terms, considered above, there is the relation of exclusion among them. Instead of considering terms by reference to their community or degrees of generality, we may consider them by reference to their contrast or difference. Thus, greater is opposed to less, hot to cold, black to white, and light to darkness. Terms, when thus related, are called **opposite or contrary terms.** Two terms may be said to be contrarily related when the truth of one implies the falsity of the other, but not conversely. When, for example, we say that the table before us is black, we cannot maintain at the same time that it is white. It may be black in one part and white in another, or it may be black now but white afterwards, but it cannot be both black and white at the same time and in the same portion. The prophecy of the witches in Macbeth—"lesser than Macbeth, and greater; not so happy, yet much happier"—could carry any sense only when the conflicting estimates

Contrary terms distinguished from contradictory.

were interpreted in different senses. Contrary terms, however, should be distinguished from those that are contradictory. **Contradictory terms** are mutually exclusive, and, taken together, they cover the whole universe. Thus, black and not-black, hot and not-hot, greater and not-greater are contradictory terms. Taken together, they embrace the whole sphere of thought and existence, leaving no room for any intermediate possibility. Contradictory terms, therefore, imply not only that if one of them be true, the other must be false, but also that, if one be false, the other must be true. The points of difference between contrary and contradictory terms may briefly be indicated thus :—

(1) Contrary terms taken together do not embrace the whole universe, while contradictory terms do.

(1) In the case of contrary terms, taken together, they do not cover the whole universe. We cannot, for example, maintain that black and white things are the only objects which constitute the universe. There are many things of some other colour or of no colour at all. Contradictory terms, on the other hand, embrace the entire universe. Black and not-black taken together constitute all that exist or all we can possibly imagine. 'Not-black' really includes everything else besides 'black', whether having any colour or not. What is excluded from one is included in the other.

(2) In the case of contrary terms, if one be true, the other is false; but not *vice versa.*

(2) The other point of difference is that, in the case of contrary terms, if one be true, the other is false ; but not conversely. If, for example, it be false that the table before me is not black, it

does not follow that it must be white ; it may be of a different colour. In the case of contradictory terms, on the other hand, not only does the truth of one imply the falsity of the other, but the falsity of one implies also the truth of the other. When, for example, it is true that the table before me is black, it follows that it cannot at the same time be not-black. If again it be false that the table is black, then it necesarily follows that it must be not-black. Black and not-black, taken together, divide between them the entire universe of thought and existence. If, therefore, an object be excluded from one of these contradictory terms, then it must be included in the other, for there is no intermediate class or territory where it may find a place.

But in the case of contradictory terms, if one be true the other is false, and also *vice versa*.

# CHAPTER V.

## CLASSIFICATION OF TERMS.

§ 1. **Classification Involves Principle.** Every classification implies a systematic arrangement of materials; and there can be system only when there is procedure on principle. Random enumeration of things leads only to a medley of diverse objects jumbled together, and serving no useful purpose. Scientific knowledge being precise and systematic always involves classification; and classification is systematic exposition on some principle. We may, for example, classify material bodies into solids, liquids, and gases according to the degree of cohesive force among the constituent particles or atoms. Similarly, we may classify students into intelligent and unintelligent, the principle of classification being the presence or absence of intelligence. We may classify students into other classes on other principles. For example, we may classify them into those that are tall and those that are short in respect of stature, or into those that are fair and those that are dark in respect of complexion. We see, then, that one and the same group of objects may be arranged differently on different principles. Terms, likewise, may be arranged in different classes according to different

Classification is a systematic arrangement based on a principle.

Terms may be classified into different classes ac-

cording to different principles.

principles of classification. Let us, therefore, proceed to study terms under different classes based on different principles.

Table of Classification.

§ **2. General Scheme of Classification.** Before proceeding to study the different classes of terms in detail, let us represent the general plan of classification in a tabular form thus :—

Terms ...

1. Simple, *e. g.*, duty, student. / Composite, *e.g.*, duty to God, diligent student.
2. Univocal, *e. g.*, copper, street. / Equivocal, *e. g.*, virtue, horse.
3. Singular, *e. g.*, John, the earth. / General, *e. g.*, man, planet.
4. Distributive, *e. g.*, man, student. / Collective, *e. g.*, a nation, a class.
5. Definite, *e.g.*, John, the present Viceroy of India. / Indefinite, *e. g.*, a student, a Viceroy.
6. Concrete, *e. g.*, stone, man. / Abstract, *e. g.*, hardness, colour.
7. Positive, *e. g.*, good, transparent. / Negative, *e. g.*, not-good, opaque. / Privative, *e. g.*, blind, barren.
8. Absolute, *e. g.*, man, table. / Relative, *e. g.*, king, son.
9. Connotative, *e. g.*, man, the sun. / Non-connotative, *e. g.*, John, circularity.

One and the same term may come under different classes.

It should be remembered that the classes are not mutually exclusive. One and the same term may from one stand-point come under one head, while from a different stand-point it may come under a

different head. As, for example, one and the same student may be brought under intelligent, tall, and fair, so one and the same term, say, Kangaroo, may be considered under different heads, such as simple, univocal, general, distributive, definite, concrete, positive, absolute, and connotative.

§ 3. (1) **Simple and Composite Terms.** A simple term is one which is composed of one word; it may be called *single-worded*, such as man, colour, library, book. A composite term, on the other hand, consists of more words than one; it may be called *many-worded*, such as an honest man, the present Viceroy of India, Socrates who was the son of Sophroniscus and husband of Xanthippe. A composite or many-worded term may be extended to any length, provided it represents only a single object of thought.

(1) A simple term is composed of one word; while a composite term, of more than one.

§ 4. (2) **Univocal and Equivocal Terms.** A term is said to be univocal when it has only one definite sense, such as, railway, rupee, oxygen, sparrow. An equivocal term, on the other hand, bears more than one sense; it is otherwise known as ambiguous, such as foot, sceptre, sleeper, vice. Though many terms seem at the outset to be univocal, closer examination reveals that the number of equivocal terms is enormously large. Even such terms as man, house, table, book, pen are not free from ambiguity. The definite sense of a term in any case is to be determined by reference to its context. (*Vide* Chap. VI, § 2.) An

(2) A univocal term has a single sense, while an equivocal term is ambiguous.

ambiguous term is really equivalent to two or more terms, according to the number of its senses ; and it should always be so treated in logic, when divorced from context.

(3) A singular term indicates an individual; while a general term, a class.

§ 5. (3) **Singular and General Terms.** A term is said to be singular when it points out an individual object. For example, John, the Ravenshaw College, the table present before me are singular terms : all of them refer to particular objects, and to nothing else. A general term, on the other hand, is one which is applicable in the same sense to any one of several objects composing a class. For example, man, tree, book are general terms, in as much as they may be applied in the same sense to this man or that man, this tree or that tree, this book or that book. A general term implies that there are certain common and essential attributes present in certain objects by reason of which the term is applicable to them in the same sense.

(4) A distributive term is applicable to several individuals separately, while a collective term is applicable to individuals taken together or as a group.

§ 6. (4) **Distributive and Collective Terms.** A term is said to be distributive when it is applicable in the same sense to any one of several objects constituting a class. Thus, general terms, considered above, are ordinarily distributive. The term 'man', 'tree,' or 'book,' for example, is applicable to any one member of its own appropriate class. A collective term, on the other hand, indicates a group of objects, to which alone it is applicable, and not to the several individuals composing the group. For example, a library, the

first-year class, a forest, a senate, an army are collective terms, as all of them refer to groups and not to individuals as members of a class.

The principle of this classification is different from that of the preceding in as much we consider here not one object but several objects, viewed either separately or as constituting a group, while in the preceding case (*viz.*, 3) the principle rests on the assumption of either single or several objects. The question in (3) is whether one or many, while the question here is whether "any one of many or many in one." (Mr. Read, *Logic*, p. 32.)

Collective terms may further be sub-divided into singular and general.

It may be mentioned in this connection that collective terms may again be subdivided into singular and general. A general collective term is one which is applicable in the same sense to any one of several groups of objects. For example, the terms 'library', 'senate,' 'the first-year class' may be regarded as general, as indicating any one of several libraries, senates, and first-year classes. A collective term is said to be singular when it indicates only a particular group, and not any other. For example, the Madras Presidency College Library, the first-year class of the Revenshaw College of 1912, the present senate of the Calcutta University are singular collective terms as they are applicable to particular collections alone.

(5) The sphere of application of a definite term is pre-

§ **7**. (5) **Definite and Indefinite Terms.** A term may be said to be definite when it precisely indicates an individual or the members of

cise, while that of an indefinite term is vague and uncertain.

a class. Thus proper names, special designations, and general terms implying an entire class may be said to be definite, as no room for doubt is left in the sphere of their application. 'James,' 'the sun,' 'the moon,' 'the present Vice-Chancellor of the Calcutta University', 'every man,' 'no man' may be regarded as definite, as every one of these terms is applicable to a definite object of thought. An indefinite term, on the other hand, is one the sphere of whose application is uncertain within certain limits. Thus, singular terms not specialized or general terms in their partial application may be viewed as indefinite. 'Vice-Chancellor of the Calcutta University,' 'a certain Englishman,' 'some men' may, therefore, be taken as indefinite, as they do not specially indicate some one individual or the members of a class. The importance of this distinction will be clear when we come to discuss the quantities of propositions. (*Vide* Chap. VII, § 5.)

(6) Concrete terms indicate objects with qualities, while abstract terms indicate qualities viewed apart from the objects in which they are found.

§ 8. (6) **Concrete and Abstract Terms.** Terms may be divided into concrete and abstract according as they indicate objects with qualities or mere qualities considered apart from the objects in which they are found. For example, 'man,' 'table,' 'book' are concrete terms. They indicate definite objects having certain qualities. The terms 'wisdom,' 'redness,' 'height' are abstract, in as much as they express certain qualities or features apart from the objects in which they are found. Adjectives, however, are to be regarded

as concrete and not as abstract ; and they are ordinarily general. 'Good', 'high,' and 'white', for example, indicate qualities of things that are so, and not merely goodness, height, and whiteness. 'The most perfect and holy,' similarly, implies the Being who is so and not simply exalted perfection and holiness. Adjectives and participles, expressing the qualities or attributes of things, are known in Logic as **attributives**.

Concrete and abstract terms may be divided into singular and general.

It should be noted in this connection that the distinction of singular and general is applicable also to concrete and abstract terms. The term 'book,' for example, is a concrete term which is general, in as much as it is applicable in the same sense to any one of several books. The term 'the book which I hold in my hand' is a singular concrete term, as it refers to the particular book before me. Abstract terms may, similarly, be divided into singular and general. An abstract term is said to be general when it expresses a quality which admits of variation in kind. For example, the term 'colour' or 'virtue' is general and abstract, in as much as it stands for any one of the several kinds of colour or virtue. A singular abstract term, on the other hand, is one which expresses a definite quality or feature, not admitting of any variation in kind. The terms 'visibleness,' 'squareness,' 'justice' may thus be regarded as singular and abstract.

Different views as to the division

We may mention here that opinion is divided as to the division of abstract terms into singular

abstract terms into singular and general.

and general. In fact, all possible views have been held : (1) Some are disposed to hold that all abstract terms are general, in as much as the quality indicated by an abstract term is illustrated in several objects. (2) Others contend that the quality is always one and the same, no matter whether it is illustrated in one or many objects. "Redness," says Jevons, "so far as it is redness merely, is one and the same everywhere, and possesses absolute oneness." (*Principles of Science*, p. 28.) (3) To avoid such dispute, some are led to maintain that the abstract terms constitute a unique class upon which the distinction of singular and general should never be forced. (4) The fourth possible view is generally maintained by logicians, *viz.*, that some abstract terms are singular and some general. Mill writes, "Do abstract names belong to the class of general or to that of singular names? Some of them are certainly general. I mean those which are names not of one single and definite attribute, but of a class of attributes. Such is the word *colour*, which is a name common to whiteness, redness, etc. Such is even the word whiteness, in respect of the different shades of whiteness to which it is applied in common ; the word magnitude, in respect of the various degrees of magnitude and the various dimensions of space ; the word weight, in respect of the various degrees of weight. Such also is the word *attribute* itself, the common name of all particular attributes. But when only one attribute,

neither variable in degree nor in kind, is designated by the name; as visibleness; tangibleness; equality; squareness; milkwhiteness; then the name can hardly be considered general; for though it denotes an attribute of many different objects, the attribute itself is always conceived as one, not many." (*Logic*, I. p. 30.) We have adopted this last view, excluding, however, the supposition that differences of degree can be a ground of generality. Such a supposition would serve only to give rise to endless difficulties. Is milk-whiteness, for example, of uniform degree in all cases? Is buffalo's milk, for instance, exactly as white as cow's? It would thus be better to maintain that abstract terms, implying qualities which admit of variation in kind alone, are to be regarded as general, while other abstract terms are singular.

(7) A positive term indicates the presence, while a negative term, the absence of a thing or quality.

§ **9.** (7) **Positive, Negative, and Privative Terms.** A term is said to be positive when it expresses the presence of a quality or an object; for example, 'man,' 'the sun', 'the moon,' 'pleasure.' A negative term, on the other hand, is one which expresses the absence of a quality or an object; for example, 'not-red,' 'unnatural', 'inexplicable,' 'not-man.' A privative term may be said to partake of the characters of both positive and negative terms. In one aspect it is negative, while in a different aspect it is positive. A privative term expresses the present absence of a quality or an attribute; but at the same time it implies the capacity for it. The term

A privative term indicates the present absence of a quality, but at the same time implies capacity for it.

'blind,' for example, is privative in as much as it implies the present absence of vision; but at the same time it implies the capacity for it. We never call a table or a stone blind; but we call living beings, endowed with the power of sight, 'blind,' if destitute of vision. In such cases the capacity for vision is implied; if the physical defect be removed, the person whom we call blind would be able to see.

The positive, negative, or privative character of a term is to be determined by reference to its meaning.

It is to be distinctly remembered in this connection, that the positive, negative, or privative character of a term should be determined by reference to its meaning and not by reference to its form. A term, for example, which may seem from its composition to be either positive or negative, may really be the reverse. The terms, 'idleness,' 'doubt', 'opacity,' for example, may seem from their form to be positive; but when we inquire into their meanings, we find that they are negative. 'Idleness,' for example, implies the absence of work; 'doubt,' the absence of belief; and 'opacity,' the absence of transparency. Similarly, 'unpleasant', 'disagreeable,' 'unhappy,' though negative in form, are really positive, the sense being the presence of an element of pain or misery, and not merely the absence of pleasure or happiness. Negative terms are ordinarily formed by the prefix 'not' or 'non'. Thus, 'unpleasant' is positive, but 'not-pleasant' is negative, as it implies simply the absence of pleasant experience. Similarly, though 'disagreeable' and 'unhappy' are positives, yet 'non-agree-

able' and 'not-happy' are negatives. Whether a term is negative or privative is to be determined by reference to the possibility of the presence of the quality in question in future. In the absence of positive proof, such a possibility is to be presumed, and so the term treated as privative. Thus, 'idle,' 'ignorant,' 'barren' are to be viewed as privative, instead of negative. It would seem that while attributives may be treated as privative, the corresponding abstract terms are to be regarded as negative. Thus, 'idle' or 'ignorant,' referring to a person, may imply the capacity for work or knowledge; but 'idleness' or 'ignorance' can never imply such a possibility.

(8) An absolute term is intelligible by itself, while a relative term can be understood only in relation to another term.

§ **10.** (8) **Absolute and Relative Terms.** A term is said to be absolute when it is intelligible by itself, without any necessary reference to the meaning of any other term. 'Table', 'inkstand', 'men' are examples of absolute terms, in as much as we understand what these objects are without any necessary reference to anything else. 'Table,' for example, does not necessarily involve a reference to other things, such as benches, chairs, or punkhas; it is intelligible by itself. A relative term, on the other hand, is one the meaning of which is not at all intelligible but by reference to the meaning of some other term. The terms 'parent', 'teacher,' 'monarch,' 'master' are all relative, in as much as all of them carry reference to some other terms. 'Parent,' for example, implies 'children'; 'teacher' involves a reference to the taught; 'monarch' carries

a reference to subjects; and 'master' is intelligible by reference to servant. The best test of a relative term is that it cannot be understood at all without a reference to the meaning of some other term. Terms related to each other in such a way are said to be *correlatives*, as their meanings are locked in the same relation. What makes, for example, 'hunter—game' related is their mutual connection in the chase. "A name," says Mill, "is said to be relative, when, over and above the object which it denotes, it implies in its signification the existence of another object, also deriving a denomination from the same fact which is the ground of the first name." (*Logic*, I. p. 46.) It appears that negative and privative terms are relative, as they always involve reference to the corresponding positive terms.

(9) A connotative term denotes a subject and implies an attribute, while a non-connotative term signifies either a thing or a quality.

§ **11.** (9) **Connotative and Non-Connotative Terms.** "A non-connotative term," says Mill, "is one which signifies a subject only, or an attribute only. A connotative term is one which denotes a subject, and implies an attribute. By a subject is here meant anything which possesses attributes." (*Logic*, I, p. 31.) Thus, a term is said to be connotative which has both a denotation and a connotation. (*Vide* Chap. IV, § 4.) Whenever a term points out individuals and at the same time signifies common and essential attributes possessed by them, the term is to be taken as connotative. For example, the term 'book' is a connotative term, in as much as it indicates

different individual books and at the same time implies the common and essential attributes found in all books. Likewise, the terms 'virtue' and 'library' are to be treated as connotative, having two senses—one in denotation and the other in connotation. A non-connotative term, on the other hand, is one which has only one meaning. It points out either an individual or a quality and nothing else. For example, the term 'circularity' is non-connotative, implying merely the quality of being circular. Proper names are generally regarded as non-connotative. They are taken to be unmeaning marks put upon individuals just to point them out. The name 'John,' for example, indicates a particular individual, and it does not signify anything else.

Proper names are regarded by some as non-connotative and by others as connotative. Mill.

It may be mentioned in this connection that writers are not agreed as to their estimate of proper names: some logicians take them to be non-connotative, while others hold that they are connotative. Mill, for example, advocating the former view, says, "A proper name is but an unmeaning mark which we connect in our minds with the idea of the object, in order that whenever the mark meets our eyes or occurs to our thoughts, we may think of that individual object". (*Logic*, I, p. 36-37.) And he observes, "When we name a child by the name Paul, or a dog by the name Cæsar, these names are simply marks used to enable those individuals to be made subjects of discourse. It may be said, indeed, that we must have had

some reason for giving them those names rather than any others : and this is true ; but the name, once given, becomes independent of the reason. A man may have been named John, because that was the name of his father ; a town may have been named Dartmouth, because it is situated at the mouth of the Dart. But it is no part of the signification of the word John, that the father of the person so called bore the same name ; nor even of the word Dartmouth, to be situated at the mouth of the Dart. If sand should choke up the mouth of the river, or an earthquake change its course, and remove it to a distance from the town, the name of the town would not necessarily be changed." (*Ibid.*, p. 34.) Against this view of Mill, Jevons maintains that proper names are connotative. "Surely," says Jevons, "no one who uses the name England, and knows what it denotes, can be ignorant of the peculiar qualities and circumstances of the country, and these form the connotation of the term. To any one who knows the town Dartmouth the name must imply the possession of the circumstances by which that town is characterised at the present time. If the river Dart should be destroyed or removed, the town would so far be altered, and the signification of the name changed. The name would no longer denote a town situated on the Dart, but one which was *fomerly* situated on the Dart, and it would be by a mere historical accident that the form of the name did not appear suitable to the town. So

again any proper name, such as John Smith, is almost without meaning until we know the John Smith in question. It is true that the name alone connotes the fact that he is a Teuton, and is a male; but, so soon as we know the exact individual it denotes, the name surely implies, also, the peculiar features, form, and character, of that individual." (*Elementary Lessons in Logic*, pp. 42-43.)

Dr. Ray holds that proper names are at the outset non-connotative, but they become connotative through familiarity.

Dr. Ray tries to reconcile the extreme views given above by holding that proper names are at first non-connotative, but gradual familiarity renders them connotative. "A proper name," he writes, "would appear to be at first without any connotation or signification of attributes, but it seems to acquire this signification as our knowledge of the individual becomes more and more definite, as its name becomes associated in our mind with its attributes, and as the attributes become a means of distinguishing that individual from others belonging to the same class or species." (*Text-Book of Logic*, pp. 40-41.) When a new class, for example, is formed, the names of the students are non-connotative to a teacher, but by gradual familiarity the names acquire meanings (such as, diligent, intelligent, or well-behaved) and so become connotative. The view of Dr. Ray is, no doubt, psychologically correct; but logically it is untenable. Logic, as we have seen, is concerned not with the mental processes but with the mental products: it does not trace the psychological history of the development of ideas in our mind:

Logically, proper names have no connotation.

it examines merely the character of thought-products as they are expected to be in a well-regulated mind conversant with truth. (*Vide* Chap. III, § 2.) Subjective connotation, as determined by progress in knowledge, is highly variable. Thus, Mr. Bosanquet observes, "A proper name has a connotation, but not a fixed general connotation. It is attached to a unique individual, and connotes whatever may be involved in his identity, or is instrumental in bringing it before the mind." (*Essentials of Logic*, p. 93.) From this stand-point it is extremely difficult to determine in any case a definite connotation of a proper name; but Logic, as we have seen, is concerned only with the fixed conventional or scientific connotation. (*Vide* Chap. IV, § 4.) And there is no fixed connotation of proper names. Psychologically considered the connotation of proper names is the greatest*; but logically viewed their connotation is *nil.*

Let us conclude this section with an enumeration of the classes of terms that are connotative and those that are not.

I. *Connotative terms:* (1) All general terms.

I. Connotative Terms:

1. It may generally be said that all general terms—whether concrete, abstract, or collective—are connotative. General terms always point out

* Thus Jevons writes, "Logicians have erroneously asserted, as it seems to me, that singular terms are devoid of meaning in intension, the fact being that they exceed all other terms in that kind of meaning." (*Principles of Science*, p. 27.)

individual objects and at the same time indicate their common and essential features.

(2) Designations and significant proper names.

2. Some singular terms which invariably point out individual objects and suggest their qualities are also connotative; for example, 'the sun,' 'the moon,' 'the present Viceroy of India.' 'The sun,' for example, points out a particular object and suggests also that it is the source of light and heat. Similar is the case with 'the moon' and 'the present Viceroy of India.' It is apparent from this that Designations as significant names of definite objects are always connotative. The difference between a proper name and a designation is thus indicated by Mr. Stock : "A Proper Name is a permanent singular term applicable to a thing in itself, *i. e.* irrespective of its particular attributes ; a Designation is a singular term devised for the occasion, or applicable to a thing only in so far as it possesses some attribute. 'Homer' is a proper name ; 'this man', 'the author of the Iliad' are designations." (*Logic*, p. 36.) Thus, singular collective terms like the British Museum, the Imperial Library of Calcutta are connotative, they being of the character of designations.

II. *Non-connotative terms* :

II. Non-connotative Terms :

(1) Proper names.

1. Proper names, as mentioned above, are non-connotative.

(2) Singular abstract terms.

2. Singular abstract terms, such as justice, equality are also non-connotative. They merely point out definite qualities and do not suggest any thing else.

§ 12. **Hints for Working Out Exercises.** (1) Before proceeding to describe the logical characters in any case first determine whether the given expression is a term or not, *i.e.*, whether it is categorematic or syncategorematic. If it be syncategorematic, its discussion falls within grammar and not within logic. For example, in the case of 'Notwithstanding', 'As well as,' it should simply be mentioned that they are syncategorematic words.

(2) In the case of a term, ascertain whether it is univocal or equivocal. If it be equivocal, it should be taken as equivalent to distinct terms corresponding to its different meanings : and its logical characters would vary according to the variation in sense. For example, 'humanity' is an equivocal term, implying (*i*) mankind and (*ii*) kindness. 'Humanity' in the sense of mankind is a singular collective term, while 'humanity' in the sense of kindness is a general abstract term ; there being different forms of kindness, such as tenderness, benevolence, and sympathy.

(3) In describing the logical characters, special care should be taken to avoid inconsistency or self-contradiction. For example, 'The' should not be described as syncategorematic and single-worded. Single-worded is a character of terms, while syncategorematic words are not terms. Similarly, 'Man' should not be described as general and non-connotative, for all general terms are known to be connotative.

(4) In doubtful cases, the meaning underlying a logical character should be mentioned. For example, 'Dead' may be taken as negative, implying the absence of life ; it may be considered as privative, when the pos-

sibility of resuscitation is assumed. Similarly, 'Idle' may be said to be negative, implying absence of work ; and 'Idle' may be taken as privative by reference to the capability to work. Thus, there should always be the endeavour to explain the logical characters of terms as clearly as possible in relation to their meanings.

## Illustrations.

1. *'Animal'* :—Categorematic, simple, equivocal (implying sentient creature or brute), general, distributive, indefinite, concrete, positive, absolute, and connotative.

2. *'Whiteness'* :—Categorematic, simple, univocal, singular, definite, abstract, positive, absolute, non-connotative.

3. *'In spite of'* :—Syncategorematic.

4. *'A dense forest'* :—Categorematic, composite, univocal, general, collective, indefinite, concrete, positive, absolute, and connotative.

5. *'The Present Governor of Bengal'* :—Categorematic, composite, univocal, singular, definite, concrete, positive, relative, and connotative.

6. *'John is insensible'* :—It is a sentence, known in logic as a proposition. It is composed of two terms—'John' and 'insensible'. Their logical characters are :—

*'John'* :—Categorematic, simple, univocal, singular, definite, concrete, positive, absolute, and non-connotative.

*'Insensible'* :—Categorematic, simple, univocal, general, indefinite, concrete, privative (implying possibility of regaining consciousness), relative, connotative.

7. *'All animals are created'* :—It is a proposition, having the terms 'animals' and 'created.'

'*Animals*' :—Logical characters as described in (1); but it is definite, implying all animals.

'*Created*' :—Categorematic, simple, univocal, general, distributive, indefinite, concrete, positive, relative, and connotative.

## § 13. Exercises.

1. Distinguish between a Term and a Word. Why is the consideration of Terms necessary in Logic?

2. Explain and illustrate the chief divisions of Terms.

3. Distinguish between (1) negative and privative, (2) singular collective and general collective, (3) singular abstract and general abstract, and (4) absolute and relative terms. To which class of terms do adjectives belong?

4. Distinguish between (1) contrary and contradictory, and (2) connotative and non-connotative terms. Name the classes of terms that are connotative and those that are non-connotative. Are proper names connotative?

5. Distingnish Ideas, Concepts, and Terms. How are Concepts formed?

6. Distinguish between the Extension and the Intension of a Concept, and point out the relation between them. Is the relation always true?

7. Define Genus, Species, and Differentia. What do you understand by Co-ordinate, Subordinate, and Superordinate Terms? Has every term a Genus and a Species?

8. Indicate the change in the denotation and the connotation of the following terms as you pass from one end to the other of each series :—

(1) Table, round table, round marble table, round marble table made by Messrs. Lazarus & Co.
(2) Creature, animal, man, Englishman.
(3) Justice, virtue, quality.
(4) Figure, curvilinear figure, circle.
(5) College, Educational Institution, Institution.

9. Give examples of terms in the ascensional order of (1) denotation and (2) connotation.

10. How do you determine the denotation and the connotation of a term? Has every term a denotation and a connotation?

11. Arrange the following terms in order of extension:—Substance, rock, solid, igneous rock, matter, thing.

12. Give three examples each of univocal, equivocal, singular abstract, general collective, and privative terms.

13. Give the genus, species, and differentia of the following terms:—Book, student, animal, building, quadrilateral, virtue, pleasure.

14. Give the contradictory and a contrary of the following:—Hot, red, good, success, man, idle, robust, rich, learned, clear.

15. Describe the logical characters of the following:—Ignorant, the Senate of the Calcutta University, the Principal of the Presidency College, James, learned, short, the College Staff, Imperial Library, an Annual Examination, inconvenient, emperor, weak, week, rose, forest, beauty, horse, cause, light, honesty, crowd, gold, evaporation, the air of the atmosphere, the weight of the earth.

# DIVISION II.

## PROPOSITIONS.

## CHAPTER VI.

### Import of Propositions.

A proposition is a Judgment expressed in language.

A judgment is the recognition of a relation between two ideas or notions.

§ 1. **Analysis of a Proposition.** Having considered terms, let us now turn our attention to the consideration of Propositions which are made up of terms. As in the case of terms, so in the case of Propositions, we find that the subjective, objective, and linguistic aspects are closely connected with one another. A Proposition is but a Judgment expressed in language. Whenever we determine the relation of one thing to another, we are said to judge, as when we think that 'Man is mortal,' 'Horses are quadrupeds,' 'John is not present'. We determine in these cases the relation between 'man' and 'mortal', 'horses' and 'quadrupeds,' 'John' and 'presence,' and arrive at an affirmative or negative judgment according to the character of the relation between them. A judgment primarily refers to the mental estimate of a relation between two ideas, and ordinarily involves belief in the connection between corresponding things, mental or material, real or imaginary. That 'Hope encourages activity,' that 'Gold is heavy,' that 'Centaurs are fabulous monsters' are judgments implying belief in a connection between facts or

images; and this belief is grounded on the recognition of a relation between the corresponding ideas or notions. Judgments as mental products become definite and precise when clothed in language. (*Vide* Chap. I, § 4); and only when so attired or expressed they can be placed before others in the form of what are called Propositions (Lat. *pro*, before, and *pono*, I place).

A Proposition consists of three parts—the subject, the predicate, and the copula.

A Proposition thus consists of three parts, *viz.*, two terms (corresponding to two notions or ideas) and the sign of a relation between them. Every proposition, accordingly, says something of something else. Now, the term of which something is said is called the *subject*; while the term, which says something of it, is called the *predicate*; and the sign expressing the relation is called the *copula*. In the proposition 'Men are mortal,' 'men' is the subject; 'mortal,' the predicate; and 'are,' the copula. Similarly, in the proposition 'Some men are not wise,' 'men' is the subject (of which the quantity is expressed by 'some'); 'wise,' the predicate; and 'are not,' the copula. The *subject* of a proposition is, therefore, the term of which something is affirmed or denied; the *predicate* is the term which is affirmed or denied of something else; and the *copula* is the sign of affirmation or denial.

The copula is represented by some form of the verb 'to be.'

To keep the three parts of a proposition distinct, the copula is always expressad in some form of the verb 'to be,' with or without the negative particle 'not,' according as a proposition is negative or affirmative. Clear statement is an

important means of clear and correct thinking; and when propositions are otherwise expressed they should be reduced to the logical form, consisting of the three parts mentioned above, before they can be logically discussed. Thus, the propositions 'John comes,' 'Men in authority sometimes abuse their power' should be reduced to the logical forms 'John is coming,' 'Some men in authority are persons abusing their power,' in which the subject, the predicate, and the copula are distinctly shown. The propositions in which the copula merges in the predicate were called by the schoolmen propositions *secundi adjacentis*, or of the second adjacent (as having two parts) as distinguished from those in which the copula is distinctly stated, called by them propositions *tertii adjacentis* or of the third adjacent (as having three parts).

It should be of the present tense,

Logicians are not agreed as to the precise form of the copula. (1) Some (*e.g.*, Mill) are of opinion that it may be of any tense of the verb to be, while others contend that it should be only of the present tense. And, as a proposition is but the expression of present estimate, it is no doubt desirable that the copula should always be of the form 'is' or 'are,' 'is not,' or 'are not,' any sign of tense being transferred to the predicate. Moreover, the element of time has no place in Logic: what is once assumed as true is regarded as fixed throughout its logical manipulation in the same discourse. Thus, 'John was there' should be reduced in logic to the form— 'John is a person who was present there.'

(2) There is dispute also about the negative particle being connected with the copula. Some (*e.g.*, Hobbes) are disposed to hold that the negative particle should be transferred to the predicate, the copula being always of the affirmative form. Thus, 'Some men are not honest' should, according to this view, be reduced to the form 'Some men are not-honest or dishonest'. It may, however, be said against this view that such an attempt would involve violence to thought as well as to language. If we think by negation as well as by affirmation, then the reduction of all propositions to the affirmative form would be quite arbitrary, involving cumbrous and at times uncouth forms of expression. Thus, the copula may be either of the affirmative or of the negative form.

either affirmative or negative,

(3) There is a furthur question as to the modality of the copula. Some contend that the mode or manner of connection between the subject and the predicate should be expressed, not in the copula, but in the predicate. The copula, according to this view, should always be in the indicative mood, merely pointing out that a relation exists between the subject and the predicate, the precise nature of the relation being explained by the predicate. Thus, 'Two and two must be four' should, according to this view, be put in the form 'Two and two are numbers which must be four'. But it may be said against this position that it would involve unnecessary circumlocution and that, since modality expresses the nature of the rela-

and expressing the character of the relation between the subject and the predicate.

tion between the subject and the predicate, it would best be indicated by the copula, which shows the relation.

The use of terms becomes narrowed by reference to context.

§ 2. **Universe of Discourse.** When two terms are joined together to form a proposition, we generally find that the use of the terms becomes narrowed by reference to context or special subject-matter. When, for example, we say 'Every body says so', we evidently mean, not all men of the universe, but only some, constituting a particular group or community. In the proposition 'All men are mortal', the term 'men' is taken in its full denotation; but in the proposition 'Men are more hardy than women', we find the term in a more restricted sense; and it is still more narrowed in the remark 'He is really a man'.

The range of the application of a term in any case determines the universe of discourse.

The range of the application of a term in any case, as determined by the intention of the speaker, constitutes what is called the *Universe of Discourse.* It was called *suppositio* by the older logicians. "The universe of discourse", says Boole, "is sometimes limited to a small portion of the actual universe of things, and is sometimes co-extensive with that universe." (*Laws of Thought*, p. 166.) Generally we find that the conventional denotation, constituting the universe of discourse in any case, is narrower than the usual denotation of a term: "What is meant to indicate", observes Dr. Venn, "is, not the whole range of objects to which a general term can be correctly applied,—this is the denotation,—but merely the restricted range to

which the speaker at the time being intends his remarks to apply. It is obvious that we often use general language when we have no intention that it should be taken in its full generality. The conditions and limitations may be of various kinds: of time, place, circumstance, and so forth, but they generally exist to some extent and are fully recognized in practice" (*Empirical Logic*, p. 180.)

The universe of discourse involves a realistic reference.

The universe of discourse brings out that reference to reality is involved more or less clearly in all judgments. Formally or subjectively considered, there can be no other restriction in the use of terms than what is enjoined by the laws of thought; but materially or objectively viewed there are the limitations due to experience or interest. By 'catholic' or 'liberal', for example, we may mean one thing in one discourse, having reference to taste or culture, and quite another in a different discourse, having reference, say, to religion or politics. The character of the universe involved in a discourse is seldom explicitly stated; it is generally understood or implied. "The particular aspect or portion of the total system of reality referred to in any judgment," says Dr. Keynes, "'may sometimes be conveniently spoken of as the *universe of discourse*. The limits, if any, intended to be placed upon the universe of discourse in any given proposition are usually not explicitly stated; but they must be considered to be implicit in the judgment which the proposi-

The character of the universe is generally implicit in discourse.

tion is meant to express, and to be capable of being themselves expressed should there be any danger of misunderstanding". (*Formal Logic*, pp. 75-76.) We should carefully remember in this connection that to overlook the universe of discourse in any case is to confound one use of a term with a different use of it and thus to commit a fallacy of ambiguity. The following argument, for example, involves such a confusion and fallacy: Water is liquid; Ice is water; therefore, Ice is liquid.

To overlook the universe of discourse is often to commit a fallacy of ambiguity.

§ 3. **The Predicables.** If we examine the terms which can be used as the subject or as the predicate of a proposition, we find that the predicate in relation to the subject must be a general term, while the subject may be either singular or general. We may, for example, say 'John is a man' or 'Kings are men'; but we can never say 'Man is John'. No doubt, we may form such propositions as 'Hyde was Clarendon', 'Zeus is Jupiter', where both the subject and the predicate are merely different names of one and the same individual. But such propositions are rather propositions in semblance than in reality: they merely bring together two names associated with the same object, without really implying anything. Thus, the predicate in relation to the subject in every significant proposition must be a general term. The classes of terms which can thus be employed as predicates are known as the *Predicables*. They are five in number, *viz.*, Genus, Species, Differentia,

The predicables mean the classes of terms which can be used as predicates.

They are— genus,

Property, and Accident. In every proposition, properly so called, the predicate in relation to the subject must be one or other of these five. For example, 'All men are animals', 'Some animals are men', illustrate that the predicate in relation to the subject is, in the one case, a genus, and, in the other, a species. Similarly, in the propositions 'Man is rational', 'Triangles have their interior angles equal to two right angles', 'John is coming,' the predicate in relation to the subject is a differentia, property, and accident respectively. We have already read the meanings of Genus, Species, and Differentia. (*Vide* Chap. IV, § 5.) Let us now consider the meanings of Property and Accident.

species, differentia, property, accident.

A *Property or Proprium* indicates a quality which is no part of the connotation of a term, but which follows from its connotation either as an effect from a cause or as a conclusion from a premise. A property may be either generic or specific according as the quality follows from the connotation of the genus or the connotation of the species. For example, 'The interior angles of a quadrilateral are together equal to four right angles' is a property, and may be considered as a specific property, following from the nature of a quadrilateral figure. Similarly, that 'Man can argue' may be regarded as a specific property following from the rationality of man. That 'The two sides of an isosceles triangle are together greater than the third' is a generic property of

The Property of a term is no part of its connotation, but follows from it.

A property is either generic or specific.

isosceles triangle, since the attribute follows from the connotation of the genus triangle. Similarly, that 'Men are influenced by pleasure and pain' may be regarded as illustrating a generic property of man, since the attribute follows from the connotation of the 'animal.'

The Accident of a term is neither a part of its connotation, nor follows from it.

An *Accident or Accidens* is a quality which is neither a part of the connotation of a term, nor does it follow from it. We should note here the points of similarity and difference between a property and an accident. The quality expressed by a property or an accident is not included in the connotation; but with this point of similarity we find an important point of difference. While the quality expressed by 'property' follows from the connotation either causally or deductively, the quality expressed by an 'accident' does not so follow. 'Accident' may be either separable or inseparable. And this distinction between separable and inseparable accident is illustrated either (*a*) with regard to a class or (*b*) with regard to an individual. (*a*) With regard to a class, a quality is considered inseparable accident when it is found in all the members of the class. For example, blackness in crow, whiteness in snow. An accident is considered as separable with regard to a class when it is found in some of its members. For example, blindness in the case of crow, hugeness in the case of snow. (*b*) With regard to an individual, an accident is considered inseparable when it is found in the

An accident is either separable or inseparable.

individual always ; for example, the date or place of birth of a particular person. An accident is viewed as separable with regard to an individual when it is found in the individual sometimes and not always ; for example, the dress of a person or his posture. It is apparent, then, that the distinction between separable and inseparable accident is considered by reference to its extent in the case of a class, and by reference to its duration in the case of an individual.

Proposition may be divided in regard to their meanings into verbal and real.

§ **4. Significance of Propositions.** When we inquire into the meanings of propositions, we find that they vary in respect of their suggestiveness or implication. And, if we overlook variation in degrees of sense, we find a broad line dividing two classes of propositions—one conveying no new information, while the other conveying such information. These two classes of propositions are known as (1) Verbal and (2) Real.

A verbal proposition conveys no new information.

(1) A proposition is said to be *Verbal* when the connotation of its predicate is included in that of its subject. For example, the propositions 'Material bodies are extended' and 'Triangles are figures' are verbal, in as much as the connotation or meaning of the predicate is but a part of the connotation or meaning of the subject. Such propositions are known as *verbal*, as they do not convey any additional information but merely express what is implied in the subject. They are also known as *Analytical* judgments or propositions in as much as they

are formed by an analysis of the connotation of the subject. They are also known as *Explicative* as they merely unfold or explain the meaning of the subject. Such propositions have also been described as *Essential* in as much as we cannot but arrive at them on an examination of the essence of the subject, *i.e.*, on an analysis of its connotation. (*Vide* Chap. I, § 5.) In a verbal proposition the predicate in relation to the subject is a genus, species, or differentia.

In it the predicate in relation to the subject is a genus, species, or differentia.

(2) As distinguished from *Verbal* propositions we have the class known as *Real*. For example, the proposition 'Man is mortal' or 'Some tables are round' is a real proposition. In such a proposition the connotation of the predicate is not a part of that of the subject. Such propositions are also known as *Synthetical* in as much as they are formed by a synthesis, union, or combination of two distinct ideas or notions. These are also known as *Ampliative* because they amplify or enlarge our knowledge of the subject. From these propositions we come to know something more about the subject than what was known to us before from its connotation. These propsitions are also described as *Accidental*, because the connection between the subject and the predicate in such propositions is due to accident or experience and not to the very nature or essence of the subject. In a real proposition the predicate in relation to the subject is either a proprium or an accident.

A real proposition conveys new information.

In it the predicate in relation to the subject is a proprium or an accident.

§ 5. **Theories of Predication.** By a

Theory of Predication we are to understand the view held by a writer as to the meaning of a proposition. A proposition involves predication, *i. e.*, the affirmation or denial of a certain relation between two terms: in every proposition one term is predicated, *i. e.*, affirmed or denied of another. Now, any opinion of the meaning of a proposition must be based on an estimate of the character of the subject, the predicate, and the relation between them. Some writers interpret the subject and the predicate in one way, while other writers interpret them in a different way; and there is also variation of opinion on the character of the relation existing between the subject and the predicate. These different views constitute the different Theories of Predication, which we shall briefly notice here. (A) From the purely logical stand-point the terms of a proposition may be interpreted either denotatively or connotatively and their relation may be one of succession, co-existence, equality, or inequality. (B) But, from the psychological stand-point, we may interpret the terms conceptualistically, realistically, or nominalistically. Let us consider the different Theories of Predication from these two stand-points separately.

A theory of predication indicates a view of the meaning of the subject and the predicate of a proposition and of the character of the relation between them.

Theories of predication have been held from (A) the logical and (B) the psychological stand-point.

(A) From the logical stand-point, four possible views may be held, one of which is not at all tenable. The four possible views are: (1) the subject interpreted in denotation and the predicate in connotation; (2) both the subject and

(A) Four possible views, one of which is untenable:

the predicate taken in denotation; (3) both taken in connotation; or (4) the subject in connotation and the predicate in denotation. Of these possible views, the last is quite untenable. In the proposition, 'Man is mortal,' for example, if we take the subject in connotation, implying 'humanity,' and the predicate in denotation, indicating 'mortal beings,' the proposition evidently can carry no intelligible sense: we can never maintain that mortal beings go with humanity or that humanity is included in mortal beings. Thus, the last possible view is rejected. The other three views are known respectively as (I) the predicative, (II) the denotative, and (III) the connotative view. Let us consider them one by one.

I. The Predicative View, which takes the subject in denotation and the predicate in connotation.

(I) **The Predicative or Ordinary View.** According to this view, the subject of a proposition is taken in denotation and the predicate in connotation. The meaning of 'Man is mortal,' for example, is that human beings possess the quality or attribute of mortality. Similarly, 'No men are perfect' means that human beings do not in any case possess perfection. This is the view supported by Drs. Martineau and Venn, who contend that a proposition expresses a relation between a thing or things and an attribute or attributes. This is known as the ordinary view, as it is quite in keeping with the common opinion of people.

II. The Denotative View, which interprets both the

(II) **The Denotative or Class View.** According to this view, both the subject and the predicate of a proposition are taken in denotation; and

the relation existing between the two terms is taken to be one of inclusion or exclusion, according as the proposition is affimative or negative. The meaning of the proposition 'All men are mortal,' for example, is that human beings are included in mortal beings ; the latter being a wider class comprehending the former. Similarly, the meaning of the proposition, 'No men are perfect,' is that human beings are excluded from those who may be called perfect. This view underlies the whole Aristotelian account of inference. The subject and the predicate interpreted in denotation imply that the former is included in, or excluded from, the latter. No doubt, in some cases the denotation of the subject may be co-exetensive with that of the predicate, as in the proposition 'Triangles are three-sided figures.' But generally speaking the relation between the subject and the predicate from this stand-point is one of inclusion or exclusion. This view may be taken to include the view of Hobbes, according to which the meaning of a proposition is that the predicate of a proposition is a name of that of which the subject is a name. For example, the meaning of the proposition 'Men are mortal,' according to Hobbes, is that the name 'mortal' can be applied to those beings that are called 'men.' "Truth," says Hobbes, "consisteth in the right ordering of names in our affirmations." And elsewhere he observes, "It is true (for example) that *man is a living creature*, but it is for this reason, that it pleased

subject and the predicate in denotation.

The view of Hobbes is analogous.

men to impose both these names on the same thing."

III. The Connotative View which construes both the subject and the predicate in connotation.

(III) **The Connotative or Attributive View.** According to this view, both the subject and the predicate of a proposition are to be understood in connotation. The meaning of the proposition 'All men are mortal,' for example, is that the attribute of mortality accompanies the group of attributes known as humanity. Wherever the group of attibutes constituting humanity is found, there the attribute of mortality is also to be met with ; in other words, mortality co-exists with humanity. This view is supported by Mill and others, who contend that the meaning of every proposition is to be interpreted in connotation ; the connotation of the predicate accompanying or not accompanying the group of attributes constituting the subject, according as the proposition is affirmative or negative.

IV The Comprehensive View combining the Denotative and Connotative Views.

(IV) **The Comprehensive or Denotative-Connotative View.** A fourth view has been maintained by some logicians, which involves a combination of the last two views (*viz.*, II and III). Hamilton, for example, contends that both the subject and the predicate of a proposition may be interpreted either in denotation or in connotation. In the former case, the subject is included in the predicate ; and, in the latter, the predicate is included in the subject. "We may," he writes, "articulately define a judgment or proposition to be the product of that act in which we pronounce

that of two notions, thought as subject and as predicate, the one does or does not constitute a part of the other, either in the quantity of Extension, or in the quantity of Comprehension." (*Logic*, I, p. 229.) Though there is thus a quantitative relation between the subject and the predicate in either case, yet the interpretation of the copula is to be modified according as the terms are taken in denotation or in connotation. "In the one process,—that, to wit, in extension, the copula *is* means *is contained under*, whereas in the other, it means *comprehends in*." (*Ibid.*, p. 274.) The proposition 'Man is mortal,' for example, when construed in denotation, means 'man' as a class is included in the wider class of 'mortal beings'; and, when interpreted in connotation, the proposition means that 'mortality' as an attribute is comprehended in the group of attributes constituting 'humanity.'

From this stand-point the meaning of the copula is modified according as the terms are taken in denotation or in connotation.

The above account of the Theory of Predication is purely from the logical stand-point. The function and province of logic are indeed different from those of psychology or philosophy. Still, the psychological construction, put upon the subject and the predicate of a proposition, affects its logical interpretation. If, for example, the subject and the predicate of a proposition be understood as standing for ideas, we get one meaning; if, on the other hand, the subject and the predicate be viewed as standing for actually existing things, we get a different meaning of the proposition.

Thus, the psychological stand-point colours the logical.

(B) Theories of predication from the psychological stand-point.

(B) The Theory of Predication as affected by the psychological stand-point may be explained thus :—

(i) The Subjective View, which interprets the subject and the predicate as indicating ideas, and the relation between them as one of congruence or incongruence.

(i) **The Subjective or Conceptualistic View.** According to this view the subject and the predicate of a proposition are to be understood as standing for concepts, notions, or ideas ; and a relation between the subject and the predicate is one of agreement or disagreement, according as the proposition is affirmative or negative. For example, the proposition 'Man is mortal' means from this stand-point that there is agreement between the ideas of 'humanity' and 'mortality.' Similarly, the proposition, 'No men are perfect,' implies that there is disagreement or discord between the ideas of 'humanity' and 'perfection'.

(ii) The Objective View, which interprets a proposition as implying an actual connection be tween real things.

(ii) **The Objective or Materialistic View.** According to this view the subject and the predicate are to be understood as really existing things ; and the relation between the subject and the predicate, according to Mill, may be one of five different kinds,—namely, (*a*) existence, (*b*) co-existence (or order in place), (*c*) succession (or order in time), (*d*) causation, (*e*) resemblance. Whenever we get a proposition, some one of these relations exists between the things indicated by the subject and the predicate. Bain reduces these five relations to three, *viz.*, (*a*) co-existence, (*b*) succession (including causation), and (*c*) equality or inequality. For example, the

meaning of the proposition 'Man is mortal' is that mortality co-exists with humanity; in other words, there is a relation of co-existence between the things expressed by the subject and the predicate. Similarly, the other relations may be illustrated. No doubt, in every real proposition there is one or other of these relations present; but in a verbal proposition the relation between the subject and the predicate is evidently one of inclusion. The objective view assumes two different aspects, namely—

This view assumes two different forms:

(*a*) Some writers (*e.g.*, Ueberweg and Dr. Venn) contend that the subject and the predicate imply ideas, but ideas corresponding to really existing things. And thus, according to this view, a proposition expresses a relation between ideas corresponding to actual things. The difference between this view, and the first view, mentioned above (*viz.*, i), is that, according to the first view, a proposition expresses a relation between ideas, whether corresponding to realities or not; while, according to this view, a proposition always expresses a real connection between two real things.

(*a*) Some hold that a proposition expresses a relation between ideas corresponding to actual things;

(*b*) Others (e.g., Spencer and Mr. Read), contend that a proposition expresses an actual relation between real things without any reference to ideas. The proposition 'Man is mortal', for example, implies, according to this view, the actual connection which exists between humanity and mortality, apart from any conception of such a relation. (*Vide* Chap. I, § 7.)

(*b*) while others hold that a proposition indicates an actual relation between real things.

This latter view is scarcely tenable, since a proposition or judgment without a mind judging is unintelligible.

The latter view is not strictly tenable. If we imagine the universe as existing with all its relations and think contemplative intelligence to be altogether absent, then there would be relations of things, no doubt, but we should never be justified in calling such relations judgments or propositions. A judgment, without a mind judging, is absurd.

(iii) The Linguistic View, which interprets a proposition as implying a relation between two terms or names.

(iii) **Linguistic or Nominalistic View.** According to this view, the subject and the predicate of a proposition stand for terms or symbols ; and the relation between the subject and the predicate is one of connection or absence of connection, according as the proposition is affirmative or negative. This view is supported by Hobbes and Whately. Hobbes, for example, interprets a proposition as implying that the predicate is the name of that of which the subject is also a name. For example, the meaning of the proposition, 'Horses are quadrupeds', is that 'quadruped' is but a name of what is called a 'horse'. But, it should be remembered that this linguistic view can never be held by itself; it must be combined either with the first or with the second view. In other words, language must stand either for ideas or for things. Language, which does not imply either thoughts or things, is an unmeaning combination of symbols ; it is but a jargon or nonsense.

# CHAPTER VII.

## CLASSIFICATION OF PROPOSITIONS.

§ 1. **General Scheme of Classification.** Like terms, Propositions may be classified according to different principles into different classes. We may, accordingly, classify propositions thus :—

Table of classification.

Propositions
- 1. According to Composition
  - Simple, *e.g.*, S is P ; S is not P.
  - Compound, *e.g.*, S as well as R is P ; neither S nor Q is P ; S is P and T.
- 2. According to Relation
  - Categorical, *e.g.*, S is P ; S is not P.
  - Conditional
    - Hypothetical, *e.g.*, If S is R, P is Q.
    - Disjunctive, *e.g.*, S is either P or Q.
- 3. According to Quality
  - Affirmative, *e.g.*, S is P.
  - Negative, *e.g.*, S is not P.
- 4. According to Quantity
  - Universal, *e.g.*, All S is P ; No S is P.
  - Particular, *e.g.*, Some S is P ; Some S is not P.
- 5. According to Modality
  - Necessary, *e.g.*, S must be P.
  - Assertory, *e.g.*, S is P.
  - Problematic, *e.g.*, S may be P.
- 6. According to Significance
  - Verbal, *e.g.*, Man is rational.
  - Real, *e.g.*, Man is mortal.

Let us consider these classes of Propositions one by one.

§ 2. **Simple and Compound Propositions.** A simple proposition expresses a single

A simple proposition

expresses a single judgment,

judgment or relation between two concepts or terms, *e.g.*, 'All men are mortal,' 'Some tables are not round.' Here a relation is expressed between the terms 'men' and 'mortal' in the one case, and 'table' and 'round' in the other. A compound proposition, on the other hand, combines more than one proposition in a single statement, e.g., 'John and James are present'; 'Ram is neither intelligent nor diligent.' The first of these propositions is equivalent to two, *viz.*, John is present and James is present; and the second unites in it the two propositions, Ram is not intelligent and Ram is not diligent. A combination of two or more affirmative propositions is called *copulative*, such as 'Cunning as well as hypocrisy is to be avoided'; while a combination of two or more negative propositions is called *remotive*, such as 'Neither cunning nor hypocrisy is good'. In examining arguments, compound propositions have to be resolved into their constituent simple parts.

while a compound proposition expresses a combination of more judgments than one.

§ **3. Classification according to Relation.** When we take into consideration *the character of relation* existing between the subject and the predicate of a proposition, we find that propositions may be classified into (i) Categorical and (ii) Conditional. (i) A *Categorical* proposition is one which expresses a relation between the subject and the predicate categorically or unconditionally. For example, the propositions 'Man is mortal', 'Fire is hot' are *categorical* propositions, in as much as they express a rela-

(i) A Categorical proposition expresses a relation between its subject and predicate without any condition,

tion between the subject and the predicate without any condition or restriction. 'Mortality' is affirmed of 'man,' and 'the quality of being hot' is affirmed of 'fire,' without any condition or restriction whatsoever. (ii) A *Conditional* proposition, on the other hand, is one which expresses a relation between the subject and the predicate, subject to a condition or restriction. For example, the propositions 'If John is not at Calcutta, he is here,' 'If it rains, I shall not go out,' and 'James is either foolish or wicked' are *conditional* propositions, in as much as they express a relation between the subject and the predicate, subject to certain conditions. It is not, for example, said unconditionally that John is here or that James is wicked: all that is meant is that 'If John is not at Calcutta he is here', and that 'If James is not foolish he is wicked.' As such propositions express a relation between the subject and the predicate under some condition or restriction, they are known as *conditional* propositions.

while (ii) a Conditional proposition expresses a relation subject to a condition or restriction.

*Conditional* propositions may again be subdivided into (*a*) Hypothetical and (*b*) Disjunctive.

Conditional propositions are subdivided into (*a*) Hypothetical

(*a*) A *Hypothetical* proposition is of the form 'If there is the sun, there is light,' 'When he comes, I shall go.' In such propositions, the first part which expresses the condition is called the *antecedent*, and the second part, namely what follows, is known as the *consequent*. In the above illustration 'if there is the sun' and 'when he comes' are the

*antecedents*, while 'there is light' and 'I shall go' are known as *consequents*. *Hypothetical* propositions are always logically reducible to the form 'If—then—.'For example, the second illustration given above may be reduced to the form "If he comes, then I shall go." It is evident from these examples that in a hypothetical proposition, predication explicitly depends on a prior condition, assumption, or hypothesis. When we say 'If a person is industrious, he prospers,' 'If the wind rises, there is rain,' we do not unconditionally affirm prosperity or rain. The effect in each case is found to depend on a prior condition, distinctly mentioned before.

It should be remembered in this connection that the antecedent of a hypothetical proposition corresponds to the subject of a categorical one, and the consequent corresponds to the predicate. A hypothetical proposition may thus be reduced to the categorical form, and *vice versa*. For example, the hypothetical proposition 'If there is the sun, there is light', when reduced to the categorical form, stands thus—'The case of the existence of the sun is a case of the existence of light.'

and (*b*) Disjunctive.

(*b*) *Disjunctive* propositions are of the form 'A is either B or C,' 'John is either wicked or foolish', 'Man is either mortal or immortal.' In a *disjunctive* proposition alternatives are mentioned, of which at least one is true. The proposition "John is either wicked or foolish" implies, for example, that—

A disjunctive proposition may be resolved into two or four hypotheticals, according to

(1) If John is not foolish, he is wicked ;

(2) If John is not wicked, he is foolish;
(3) If John is foolish, he is not wicked;
(4) If John is wicked, he is not foolish.

This is the view advocated by Ueberweg and others who contend that the alternatives of a *disjunctive* proposition are mutually exclusive (like contradictory terms), so that if one of them be false, the other must be true; and if one be true, the other must be false. It is, however, maintained by Mill and others that the members of a *disjunctive* proposition are not necessarily exclusive, so that the several alternatives may simultaneously be true. According to this view, the falsity of one alternative implies the truth of the other, but not conversely. Thus, if Ueberweg would deduce the above four hypotheticals from the single disjunctive given above, Mill and his followers would admit only the first two.

the character of the alternatives involved.

It may be mentioned in this connection that, in any particular case, we are to adopt the view of Mill or that of Ueberweg according to the character of the alternatives involved in a disjunctive proposition. When the alternatives are contradictories (as in the illustration 'Man is either mortal or immortal'), we are to adopt Ueberweg's view. When, on the other hand, the alternatives are not mutually exclusive or incompatible (as in the illustration 'John is either foolish or wicked'), we are to adopt Mill's view. It is evident from the above examples that if, in a hypothetical proposition, a condition is explicitly laid down, in a

In a hypothetical proposition, a condition

is explicitly laid down, while, in a disjunctive proposition, it is implied in the form of an alternative predication.

disjunctive proposition the condition is implied in the form of an alternative predication ; the subject and the predicate in this case are disjoined by 'Either—or.'

An Affirmative Proposition expresses the presence, while a Negative Proposition, the absence, of a connection between the subject and the predicate.

**§4. Classification according to Quality.** Propositions have also been divided into *Affirmative* and *Negative* according as the predicate is affirmed or denied of the subject. For example, the propositions 'Material bodies have weight,' 'John is honest' are *affirmative* propositions. Such propositions express the presence of a connection between the subject and the predicate. The propositions 'Man is not perfect,' 'Some tables are not round' are regarded as *negative*, there being the absence of connection between the subject and the predicate.

Many logicians are disposed to divide hypothetical propositions also into affirmative and negative. An affirmative hypothetical proposition has, according to these writers, an affirmative consequent, while a negative hypothetical has a negative consequent. Then the quality of the consequent determines the quality of the hypothetical proposition. For example, 'If A is, B is,' 'If he is well, he is expected in the evening,' are examples of affirmative hypothetical propositions. 'If A is, B is not,' 'If he is ill, he will not come' are examples of negative hypothetical propositions. In the affirmative form, the consequent is said to depend upon the antecedent, while in the negative form the consequent does not so depend.

"In the case of the hypothetical proposition," writes Dr. Ray, "the consequent depends on the antecedent; or the consequent does not depend on, or is independent of, the antecedent." (*Logic*, pp. 70-71.)

But such a position is untenable. In a hypothetical proposition there is always a relation of dependence between the antecedent and the consequent; and so hypothetical propositions are always affirmative.

A careful examination of the character of a hypothetical proposition reveals, however, that the above view is untenable. The nature of hypothetical propositions is such that there is always a relation of dependence between the antecedent and the consequent. Even when the consequent of a hopothetical proposition is negative, its meaning is, that the consequent depends on the antecendent. The meaning of the proposition 'If he is ill, he will not 'come,' for example, is not 'that his coming does not depend on his illness'; its meaning is, 'the fact of his not coming depends on his illness.' Similarly, 'If the will of Henry VIII was valid, James I had no legal title to the throne of England' does not mean that the title of James did not depend on the will of Henry: it means, on the contrary, that the absence of such a title depended on the will. In fact, if there is no relation of dependence between the antecedent and the consequent, nothing can be inferred with regard to the consequent when anything is known about the antecedent. The chair, for example, does not depend on the register. From such a relation can we infer anything with regard to one from anything that may be known to us with regard to the other? We shall revert to this topic in the chap-

ter on Mixed Syllogisms. (*Vide* Chap. XII, § 2.)

Attempts have been made by certain logicians to reduce *all* propositions to the affirmative type and thus to do away with the distinction between affirmative and negative propositions. For example, the proposition "Some men are not wise" is taken by the supporters of this view as equivaient to "Some men are not-wise or unwise"; and this proposition is regarded as affirmative, instead of negative. Similarly, the proposition 'Man is not perfect' is reduced to the form "Man is not-perfect or imperfect," which is apparently affirmative. It may be mentioned, however, that this view is not tenable. Though a negative proposition is thus apparently reduced to the affirmative form by the transference of the sign of negation to the predicate, yet the proposition in its sense continues to be negative, expressing the absence of a connection between the subject and the original predicate. (*Vide* Chapter VI, §1.)

**The nature of hypothetical and disjunctive propositions is such that they are always affirmative.**

Hypothetical propositions are regarded as affirmative, because they are the expression of a mode of thought involving a relation of dependence between the constituent notions of corresponding judgments. Without such a relation there can be no hypothetical, in the proper sense of the term. Disjunctive propositions likewise are always affirmative: in every disjunctive proposition, we are forced to accept at least one of the alternatives. "It follows from the very nature of Disjunctive Propositions," says Professor Welton, "that they

can only be affirmative ; for they must give a choice of predicates, one or other of which must be affirmed of the subject." (*Logic*, I, p. 192.) And the mutual implication of hypothetical and disjunctive propositions illustrates also community of their nature.

**§5. Classification according to Quantity.** We may classify propositions according to their quantity into *universal and particular*. When an affirmation or denial is made of an entire class the proposition is taken as *universal*, such as "All men are mortal," "No angels are mortal." In these propositions the attribute of mortality is affirmed, in the one case, and denied, in the other, of the entire class of human beings or angels respectively. Thus, a proposition is taken as universal when the subject is taken distributively, *i.e.*, in its entire extent or denotation. A proposition is taken as *particular* when the predicate is affirmed or denied of some members of the class indicated by the subject. For example, the propositions "Some men are wise", "Some tables are not round" are taken as particular, in as much as the predicate is affirmed, in the one case, and denied, in the other, of some of the beings or things expressed by the subject. We should remember, however, that the logical meaning of '*Some*' is 'at least one'; it does not necessarily exclude 'all'. 'Some men are wise,' 'Some men are mortal' merely indicate that 'wisdom' or 'mortality' belongs at least to one man, if not to all. The quantity of a particular prop-

A Universal Proposition exhausts in it an entire universe, *i.e.*, the totality of things denoted by its subject,

while a Particular Proposition does not necessarily so exhaust.

The logical meaning of 'Some' is at least one.

osition, like that of a universal one, depends on the quantity of the subject. A proposition is universal or particular according as its subject is distributed or undistributed.

Singular propositions which are definite are to be treated as universal.

Singular propositions, *i.e.*, propositions of which the subject is a singular term, are generally regarded as universal. All singular propositions, however, cannot be regarded as universal. Singular propositions of which the subject is a definite term can only be so regarded. (*Vide* Chapter V, §7.) In singular indefinite propositions our attention is directed only to a part, and not to the whole, of the extent of a certain notion. For example, in the propositions 'A thief has been arrested,' 'One metal is liquid,' we are thinking only of *some* member or instance of the class of thieves or metals, and not of the entire extent of a particular object. But the propositions 'The thief who has been arrested is now before the magistrate,' 'Mercury is a liquid metal,' are to be taken as universal, for the reference is to the entire subject-matter of a certain discourse. Similarly, 'This table is rectangular,' 'That man is honest' are to be viewed as universal, while 'A table is rectangular,' 'A man is honest,' as particular. Referring to the division of judgments into Universal, Particular, and Singular, Ueberweg observes, "Singular judgments are to be subsumed under the other two classes: under the first when the subject is definite and individually designated (*e.g.*, Cæsar, or this man); under the second when the subject is indefinite and desig-

nated only by a general notion (*e.g.*, a man or a great general). For in the first case the predicate is affirmed or denied of the *whole* sphere of the subject (which in this case is reduced to an individual), and in the other case of an indefinite *part* of the sphere of the subject-notion." (*System of Logic*, p. 214.)

Hypothetical and Disjunctive propositions are also divisible into universal and particular.

It may be mentioned in this connection that the quantity of a *hypothetical* proposition is determined by the quantity of its antecedent: if the antecedent is distributed, the proposition is universal; otherwise the proposition is particular. For example, 'In all cases, if there is fire, there is heat' is a universal proposition; while 'In some cases if men are industrious, they are successful' is particular.

Disjunctive propositions are similarly divisible into universal and particular. For example, 'Every man is either mortal or immortal,' 'Gold is either heavy or light' are universal propositions; while 'Some men are either wise or foolish,' 'Some fruits are either nourishing or stimulating' are particular.

Propositions whose quantity is not specified are called Indesignate.

Propositions whose quantity is not explicitly stated are known as *indesignate*. For example, 'Scholars are industrious,' 'Days are warm,' 'S is P' are indesignate propositions, the quantity of whose subject is not explicitly mentioned. In familiar cases of indesignate propositions, the quantity may be supplied from experience.

§ **6. Classification according to Modality.** By the modality of a proposition we are to

Modality expresses the nature of the relation between the subject and the predicate of a proposition.

understand the mode or manner of connection existing between its subject and predicate. The modality of a proposition is thus described by some writers as "a special development of its quality." The quality of a proposition, as we have seen, expresses whether a proposition is affirmative or negative, *i. e.*, whether there is the presence or absence of a connection between its subject and predicate. But, if we are not content simply with noting the presence or absence of a connection, but proceed a little further and inquire into the way in which the subject and the predicate are related to each other, we come to the modality of a proposition. Thus, propositions may be classified according to modality into (1) Necessary, (2) Assertory, and (3) Problematic.

A necessary proposition expresses an unalterable relation;

(1) A *Necessary* proposition is one in which the relation between its subject and predicate is due to the very nature of things, so that it can never possibly be otherwise. For example, 'Two and three must be five' and 'Two straight lines cannot enclose a space' are *necessary* propositions, due to the very constitution of things, so that we cannot imagine even an omnipotent power capable of altering the relation.

an assertory proposition, a relation based on facts;

(2) An *Assertory* proposition is one which expresses that the relation between its subject and predicate is true so far as our experience goes. For example, "Men are mortal" and "Some mangoes are sweet" are assertory propositions, expressing that the connection between the subject

and the predicate is true so far as it is revealed in experience.

(3) A *Problematic* or *Probable* proposition is one in which the relation between its subject and predicate, though not actually found to be true, is not inconsistent with the conditions of space and time. For example, "John may come here" and "It may rain this evening" are problematic propositions.

while a probable proposition, a relation which is not inconsistent or absurd.

**§ 7. Classification according to Significance or Import.** This has already been explained in Chapter VI, § 4.

**§ 8. Classification according to the Mixed Principle of Quality and Quantity.** If we adopt as the principle of classification both quantity and quality, then we can divide propositions into four classes, namely—

Four classes of propositions--A, E, I, and O.

(1) *Universal affirmative* (for example, 'All men are mortal', 'All A is B');

(2) *Particular affirmative* (for example, 'Some men are tall,' 'Some A is B');

(3) *Universal negative* (for example, 'No men are perfect,' 'No A is B');

(4) *Particular negative* (for example, 'Some men are not wise,' 'Some A is not B').

These four kinds of propositions are respectively represented by the symbols **A**, **I**, **E**, and **O**. **A** and **I** stand for affirmative propositions, the first for the universal and the second for the particular form. **E** and **O** stand for negative propositions, the first for the universal and the second for the particular

form. A and I come from *affirmo*, and E and O, from *nego*, the first vowel in each case standing for the universal and the second for the particular form.

The character of a proposition is to be determined by its meaning.

In determining whether a proposition is A,E,I, or O, we should take into account, not merely the form, but also the sense or meaning. For example, the propositions 'Not all men are industrious,' 'Every man is not rich,' though apparently universal, are really particular propositions, implying 'Some men are not industrious' and 'Some men are not rich.' Let us notice in this connection some of the general forms of expression which ordinarily indicate certain forms of proposition.

( 1 ) **Propositions with 'Every', 'All', 'Any.'** Affirmative propositions beginning with these words are to be treated as universal, *e.g.*, 'Every man is frail,' 'All dogs are quadrupeds', 'Any one of these will do.' Negative propositions introduced by these words are, however, to be treated as particular, *e.g.*, 'Every man is not rich,' 'All that glitters is not gold', 'Any one of these things will not do'. These propositions do not mean 'No men are rich,' 'Nothing that glitters is gold', 'None of these things will do'; they imply 'Some men are not rich,' 'Some things that glitter are not gold,' 'Some of these things will not do.'

( 2 ) **Propositions with 'Each', 'No.'** Propositions beginning with these words are to be taken as universal, *e.g.*, 'Each member of this society contributes an article to the Paper,' 'No men are perfect.'

(3) **Propositions with 'Some', 'A few', 'Many', 'Most'.** Such propositions are to be regarded as particular, *e.g.*, 'Some men are straightforward,' 'A few men are suspicious,' 'Most men are prudent.'

(4) **Propositions with 'Few'.** Affirmative statements introduced by this word have a negative force, while similar negative statements have an affirmative force. For example, 'Few men are truly pious,' 'Few are wiser than Socrates' imply 'Most men are not truly pious,' 'Most men are not wiser than Socrates'. Such propositions are, therefore, to be generally treated as O, though sometimes they may even have the force of E (*e.g.*, 'Few men can work like Hercules'). Similarly, 'Few men are not prudent,' 'Few animals cannot be trained,' signify 'Most men are prudent' 'Most animals can be trained.' They are, therefore, to be taken as I propositions, sometimes even with the force of A (*e.g.*, 'Few men are not intelligent').

(5) **Exclusive Propositions: Propositions with 'Only', 'Alone'. 'None but'** Propositions whose subjects are qualified by these words are to be taken as universal—affirmative or negative, according to the form to which they are reduced. 'Only the virtuous are happy,' for example, implies 'None except the virtuous are happy,' *i. e.*, 'No non-virtuous are happy.' Thus viewed, the proposition is to be regarded as E. But it can be easily converted into the affirmative form thus :

No non-virtuous are happy ;

=No happy men are non-virtuous (*Vide* Chap. X, § 2);

=All happy men are virtuous (*Vide* Chap, X, § 3).

It should be noticed that when the proposition is regarded as **A**, its subject is taken to be what is apparently given as its predicate. Similarly, 'None but the brave deserve the fair,' 'The Hindus alone worship the Shiva' may be taken either as **E** or as **A** propositions.

(6) **Exceptive Propositions.** General statements with indefinite exceptions are to be treated as particular, while such statements with definite exceptions are to be taken as universal. For example, 'All metals except one are solid,' 'No planets except one have atmosphere' are regarded as equivalent to 'Some metals are solid', 'Some planets have not atmosphere,' because the exceptions are not definitely known. But 'All metals except mercury are solid,' 'No planet except the earth has atmosphere' are universal, since the exception in each case is specifically indicated and hence the extent of the subject is definitely known.

It is apparent from these remarks that the logical characters of a proposition should in every case be determined by reference to its meaning.

To elucidate the meanings of propositions, diagrams may be used.

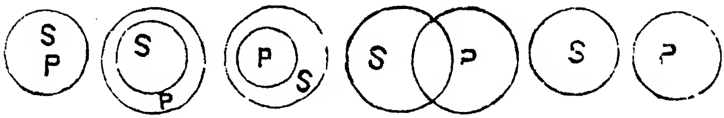
§. 9. **Diagrammatic Representation of Propositions: Euler's Circles.** The propriety of representing terms by circles or other diagrams and the relations of terms by combinations of such circles or diagrams has been questioned by

some writers. Mansel, for example, argues in his *Prolegomena Logica* that thought-relations cannot adequately be represented by space-relations illustrated in diagrams. Without entering, however, into the psychological or philosophical aspect of the question, we may simply mention here that a certain correspondence is generally recognized between symbols and their meanings, between signs and significates. Whether diagrams can adequately express the meanings of propositions, we need not discuss here; but it may be freely admitted that diagrammatic representations are highly instructive and useful. In an elementary treatise on Logic, accordingly, such representations may be used to elucidate cases to beginners. Different forms of diagrams have been used by different logicians (such as Euler, Jevons, Ueberweg, Lambert, and Venn), but we shall use the circles of Euler,* which, by reason of their simplicity, are generally employed.

If we represent the denotation of the term S by a circle, and that of P by another circle, then the

*Leonard Euler, a distinguished Swiss mathematician and logician (1707—1783) was a professor of mathematics in the Berlin Academy and the Academy of St. Petersberg. "The *use of circles*," says Ueberweg, "as an aid in the demonstration of the doctrine of Syllogism, especially in Syllogistic proper, has been referred by modern logicians (e g. by Maass, J. D. Gergonne, Bachmann, and Bolzano) to *Euler*. But Drobisch [and Hamilton] have rightly remarked that, according to the testimony of Lambert, *Joh. Chr Lange*, in his 'Nucleus Logicae Weisianae, 1712, uses circles and that *Christ. Weise*, rector of the Gymnasium at Zittau (d. 1708) was probably the inventor." (*System of Logic*, Eng. Tr., p. 302.)

relation of S to P may be shown by a combination of the two circles. As propositions differ in quantity and quality the combinations of circles are different in the different classes of propositions. The several combinations of circles used for representing the four forms of propositions, **A**, **E**, **I**, and **O** may be shown thus :




I II III IV V

If S stands for the subject, and P, for the predicate, then an **A** proposition of the form 'All S is P' is represented by diagrams I and II. Similarly, **I** ('Some S is P') is represented by I, II, III, and IV; **O** ('Some S is not P'), by III, IV, and V; and **E** ('No S is P') by V, alone.

A term is said to be distributed when it is taken in its entire extent.

§ 10. **Distribution of Terms.** A term is said to be distributed when it is taken in its entire extent or denotation; and when not so taken, it is said to be undistributed. For example, in the propositions 'All S is P', 'All men are mortal', the terms 'S' and 'men' are distributed; while in the propositions 'Some S is P,' 'Some men are wise,' 'S' and 'men' are undistributed. We should remember that the logical meaning of 'Some' is at least one; it does not necessarily exclude 'all.' For example, in the propositions 'Some material bodies have weight,' 'Some men are not perfect,' the terms

'material bodies' and 'men' have been taken in their partial extent. Nevertheless, 'All material bodies have weight,' 'No men are perfect' are known to be true. Thus, the use of a term in its partial extent does not necessarily exclude the possibility of its being taken, in certain cases, in its entire extent. All that we can say is that 'Some' means 'at least one'; it may or may not be equivalent to all.

Let us now examine the four classes of propositions, **A**, **E**, **I**, and **O**, to ascertain the terms which are distributed or undistributed in them; and let us illustrate our remarks by reference to the diagrams representing those propositions.

An **A** proposition distributes its subject but not its predicate.

An **A** proposition, as we have seen, is represented by the first and second diagrams. If we compare them, we find that the subject S is taken in its entire extent in both the cases, while the predicate P, though taken in its entire extent, in the first diagram, is not so taken in the second. Thus, generally speaking, we may say that the subject, S, is taken in its entire denotation, while the predicate, P, in its partial extent. We must remember that the partial extent or 'some' does not necessarily preclude the entire extent or 'all,' and that the latter possibility is covered by the first diagram.

**I** does not distribute any term.

An **I** proposition is represented by the first four diagrams. If we compare the diagrams, we find that the subject, S, though taken in its entire extent in the first two diagrams, is not so taken in the third or fourth. Thus, generally speaking, we may say that the subject, S, is undistributed. Similarly,

we find that the predicate, P, though distributed in the first and third diagrams, is not distributed in the second and fourth. Thus, generally speaking, we may hold that the predicate, P, is undistributed. We find, then, that in an **I** proposition neither the subject nor the predicate is distributed.

**O** distributes its predicate alone.

An **O** proposition is expressed by the last three diagrams. On comparing these diagrams we find that the predicate, P, is taken in its whole extent in all the diagrams. The whole of P is outside a part of S in the third and fourth diagrams; and the whole of P is outside the whole of S in the last diagram. Thus, generally we find that the predicate, P, is distributed. If we examine the term S we find that it is taken in its partial denotation in the third and fourth diagrams, while it is taken in its whole extent in the fifth. Thus, generally we notice that the subject, S, is undistributed.

**E** distributes both the terms.

An **E** proposition is represented by the last diagram. And here we find that the whole of S i outside the whole of P. Thus, in an **E** proposition both the subject and the predicate are distributed.

The general rules of distribution.

The most general rules relating to the distribution or non-distribution of terms are:—(1) Only universal propositions distribute their subjects, and (2) only negative propositions distribute their predicates. From these two general rules we can deduce which terms are distributed in the different propositions. For example, '**A**', being an *affirmative* proposition, does not distribute its predicate (Rule 2), and being an *universal* proposition it

distributes its subject (Rule 1). Similarly, 'E,' being *universal*, distributes its subject (Rule 1), and, being *negative*, it distributes its predicate (Rule 2). 'I,' not being universal, does not distribute its subject (Rule 1.); and, not being negative, it does not distribute its predicate (Rule 2). 'O', not being universal, does not distribute its subject (Rule 1), while, being *negative*, it distributes its predicate (Rule 2).

Thus, we find, as the result of our inquiry into the distribution and non-distribution of terms, that 'A' proposition distributes its subject only, 'I' proposition does not distribute any term, 'E' proposition distributes both its subject and predicate, and 'O' proposition distributes its predicate alone.

### § 11. Quantification of the Predicate.

In the four forms of proposition, A, E, I, and O, the quantity of the predicate is not always definitely indicated. To render this quantity definite and reduce propositions to mere relations of identity, Sir W. Hamilton has propounded his doctrine of the Quantification of the Predicate. According to him, if we interpret the terms of a proposition in denotation, the relation between them turns out to be one of equality or identity, the things denoted by the subject being equivalent to, or identical with, those denoted by the predicate. A logical proposition is, in this way, reduced simply to an equation: $S = P$. Thus, by taking the predicate as either (*a*) distributed or (*b*) undistributed we get eight forms of proposition out of the ordinarily recognized four. These eight forms are :—

By specifying the quantity of the predicate, Hamilton has tried to resolve all propositions to express the relation of identity or equality.

Eight forms of proposition.

| | | |
|---|---|---|
| Toto-total Affirmative | ...All S is all P | ...(**U**) |
| Toto-partial Affirmative | ...All S is some P | ...(**A**) |
| Parti-total Affirmative | ...Some S is all P | ...(**Y**) |
| Parti-partial Affirmative | ...Some S is some P | ...(**I**) |
| Toto-total Negative | ...No S is any P | ...(**E**) |
| Toto-partial Negative | ...No S is some P | ...(*y*) |
| Parti-total Negative | ...Some S is not any P | ...(**O**) |
| Parti-partial Negative | ...Some S is not some P | ...(*w*) |

Hamilton contends that in every judgment we think—implicitly, if not explicitly—not merely of the quantity of the subject but also of that of the predicate. And, as the postulate of logic permits us to state explicitly what is implicitly contained in thought, we may reduce the four ordinary forms of proposition to the eight forms given above. Hamilton claims for his theory the advantage of simplifying conversion and syllogistic inference and thus dispensing with their different forms and varied tests. In spite of such advantages, however, the forms are complex and cumbrous. All S is all P, for example, is really equivalent to two propositions—All S is P and All P is S. Moreover, we do not always think of the predicate in extension, and we seldom quantify it in thought. Thus, the ordinary fourfold scheme seems to be preferable to the eight-fold one of Hamilton.

**As, however, these forms are complex and cumbrous, we shall use the four forms ordinarily employed.**

## CHAPTER VIII.

### RELATION OF PROPOSITIONS: OPPOSITION.

§ 1. **Relation of Propositions.** Propositions having the same subject and predicate may either resemble or differ from one another. In order, however, that propositions may be compared together, they must have the same subject and predicate. When propositions have different subjects and predicates they cannot possibly be compared with one another. Thus, the propositions "All men are mortal," "No horses are bipeds" can never be compared together. We may then consider the relation of propositions under two heads :—

Propositions admit of comparison when they have the same subject and predicate.

(1) Under the head of similarity ;

(2) Under the head of difference.

§ 2. **Subalternation.** When propositions are related by similarity, they have the same quality besides having the same subject and predicate. Thus, both the propositions are either affirmative or negative, though the one is universal and the other is particular. This relation of propositions is known as *subalternation*. Subalternation may therefore be defined as the relation existing between two propositions having the same subject and predicate but differing only in quantity, the one being universal and the other particular. For example, the propositions A and I, E and O are related by way of sub-

Definition of Subalternation.

alternation. The propositions 'All men are mortal,' and 'Some men are mortal,' 'No men are perfect', and 'Some men are not perfect' are so related. Of propositions related in this way, the universal one is known as *subalternant* and the particular as *subalternate*, while both in relation to each other are known as *subalterns*.

§ 3. **Opposition.** When propositions having the same subject and predicate differ in quality, they illustrate this aspect of the relation of propositions.

Definition of Opposition.

*Opposition* may therefore be defined as the relation existing between two propositions having the same subject and predicate but differing in quality (they may or may not differ in quantity). Opposition is of different forms known as (*a*) contrary, (*b*) subcontrary, and (*c*) contradictory.

*Forms of Opposition*:

(*a*) Contrary.

(*a*) *Contrary Opposition.* Contrary opposition is the relation existing between two universal propositions, having the same subject and predicate, but differing in quality. Thus, contrary opposition is illustrated in the case of **A** and **E** propositions. For example, the propositions "All men are mortal" and "No men are mortal" are contrarily opposed.

(*b*) Subcontrary.

(*b*) *Subcontrary Opposition* is the relation existing between two particular propositions, having the same subject and predicate but differing in quality. Subcontrary opposition exists between **I** and **O** propositions. For example, "Some A is B" and "Some A is not B," "Some men are wise" and "Some men are not wise" are subcontrarily opposed.

(*c*) *Contradictory Opposition* is the relation existing between two propositions, having the same subject and predicate, but differing both in quality and quantity. Thus, A and O, E and I are contradictorily opposed. For example, the propositions "All tables are extended," and "Some tables are not extended," "No men are perfect" and "Some men are perfect" are contradictorily opposed.

and (*c*) Contradictory.

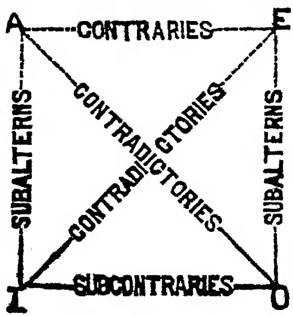
Some Logicians include Subalternation in Opposition. According to them, propositions having the same subject and predicate but differing in quality or quantity or in both are said to be opposed to each other, and such a relation is one of opposition. But it may be said against this view that propositions not differing in quality can scarcely be said to be opposed or inconsistent in any way. For example, the propositions 'All men are rational' and 'Some men are rational', 'No men are mortal' and 'Some men are not mortal' may both be true or false, there being no inconsistency or opposition between them.

Subalternation is regarded by some as a form of opposition;

but the view is not correct.

The different forms of opposition including subalternation may be represented thus in a diagram called the *Square of Opposition*:

The Square of Opposition.



**§ 4. Hints for Working out Exercises.** (1) Before describing the logical characters of propositions they should be reduced to the logical form, with subject, predicate, and copula distinctly shown. Thus, 'Every man is not industrious,' 'The industrious alone are successful,' 'Great is Diana of Ephesus', should first be reduced to their logical forms—'Some men are not industrious,' 'No non-industrious men are successful,' (or 'All successful men are industrious'), 'Diana of Ephesus is great.'

(2) Compound propositions should be resolved into the simple propositions of which they are composed; and if these be of the same nature, their logical characters may be described together. For example, 'S is neither P nor Q'; 'A and B are C' should be shown as equivalent to 'S is not P' and 'S is not Q,' 'A is C' and 'B is C,' and their logical characters described together. When, however, the component propositions are not of the same nature, their logical characters should be described separately. For example, 'James is thoughtless, but not wicked' should be resolved into 'James is thoughtless' and 'James is not wicked,' and then their logical characters described according to their respective forms.

(3) As in the case of terms, so in the case of propositions, their logical characters should always be determined by reference to their meaning, and not merely their form. And in reducing propositions to their logical form, care should be taken to secure perfect correspondence between such a form and the meaning. (*Vide* Chap. VII, § 8.)

(4) Consistency should steadily be before our mind in all logical operations. In describing the logical

characters of terms we should, therefore, not bring conflicting characters together. For example, we should not describe a proposition as hypothetical and categorical, or as disjunctive and verbal at the same time.

(5) Precision should be secured by the use of appropriate expressions in every case. For example, a proposition should not be described as 'general' or 'positive' which are characters of terms. Propositions are 'universal' or 'affirmative' since they express truths involving affirmation or negation and of a comprehensive or narrow range of application. Similarly, 'categorical' should not be confounded with 'categorematic'.

(6) In the case of Subalternation and Opposition, propositions must have the same subject and predicate. (*Vide* § 1.)

## Illustrations.

(1) '*Not all men are happy.*' Logically it is equivalent to 'Some men are not happy.' It is simple, categorical, particular, negative (O), assertory, and real.

(2) '*Two and two are equal to four.*' It is equivalent to 'All combinations of two and two must be four.' It is simple, categorical, universal, affirmative (A), necessary, and verbal.

(3) '*Where there is will there is way*' Put logically it is 'In all cases, if there is will, there is way.' It is simple, hypothetical, universal, affirmative (A), assertory, real.

(4) '*Jones as well as William is guilty.*' It is a compound proposition made up of 'Jones is guilty' and 'William is guilty.' These propositions are of the same nature. Their logical characters are—categorical, affirmative, universal (A), assertory, and real.

(5) *'Though some men are not straightforward, yet they are honest.'* It is a compound proposition equivalent to 'Some men are not straightforward' and 'They are honest.' The first of these forms is negative, while the second affirmative. The other logical characters of these propositions are—categorical, particular, assertory, and real.

§ 5 **Exercises.**

1. Define a Proposition and explain its relation to a Judgment. What do you mean by 'the Universe of Discourse'?

2. What do you understand by the Predicables? Distinguish Differentia, Proprium, and Accident. Is this distinction connected in any way with that between Real and Verbal Propositions?

3. Distinguish between (1) generic and specific property, and (2) separable and inseparable accident.

4. Give a classification of Propositions, with examples.

5. Explain the question with regard to the Import of Propositions, or Theory of Predication, and state and illustrate the principal answers that have been given to the question.

6. Distinguish between (1) Real and Verbal, and (2) Necessary and Assertory Propositions. Can Hypothetical propositions be negative?

7. Classify propositions according to quality and quantity, and illustrate them by diagrams.

8. State the general rules relating to the distribution of terms in propositions. What is Hamilton's doctrine of the quantification of the predicate? What are its advantages and disadvantages?

9. Define Opposition. Draw the Square of Opposition. Is Subalternation a kind of Opposition?

10. Reduce the following propositions to their logical form and describe their logical characters :—

(1) All mangoes are not sweet.

(2) No lover he who is not always fond.

(3) Not all who are called are chosen.

(4) Blessed be James who has saved my life.

(5) Books are generally useful.

(6) Every disease is not fatal.

(7) All is lost, save honour.

(8) Not to go on is to go back.

(9) Only law can give us liberty.

(10) Few men are wise.

(11) White cats with blue eyes are generally deaf.

(12) Great was the uproar there.

(13) None but the brave deserve the fair.

(14) The virtuous alone are truly happy.

(15) How could James be there ?

(16) Hydrogen is the lightest body known.

(17) Wealthy indeed is the man who is contented.

(18) Contradictory qualities are not to be found in objects.

(19) Matter is extended.

(20) An Englishman is the editor of this paper.

11. Mention whether the above propositions are A,E,I, or O.

12. Point out what terms are distributed or undistributed in the above propositions.

13. Give the contradictory, the contrary or subcontrary, the subalternant or subalternate of the above propositions.

14. Frame analytical and synthetical judgments with the following notions as subjects :—Animal, horse, table, teacher, education, virtue, book, house, river, star.

# DIVISION III.

## INFERENCE.

## CHAPTER IX.

### IMPORT AND CLASSIFICATION OF INFERENCES.

Inference is indirect knowledge gained through something else.

**§1. Character of Inference.** Inference indicates that form of knowledge which we arrive at by means of another. Knowledge may be either direct or indirect. Direct knowledge is acquired through observation, as when we see objects before our eyes or experience mental states present in consciousness. Mediate knowledge is the knowledge acquired through something else. For example, when we infer from the expression of a person that he is angry or afraid, or we expect that there will be rain this afternoon from the presence of clouds in the sky, we have to do with mediate knowledge. This mediate knowledge or truth comes within the province of inference. Thus, the term 'Inference' indicates that we arrive at a truth not by direct observation but by means of some other truth previously known.

Different senses in which the term Inference has been used.

The word 'Inference' has been used in at least three different senses. (1) The word 'Inference' stands for the mental process of arriving at a conclusion from certain datum or data. But, as logic is concerned with the mental product and not

with the mental process (which falls within the province of psychology), this sense of the term is comparatively rare in logic. (2) The word 'Inference' stands also for the mental product expressing mediate knowledge. In this sense, the term stands sometimes (*a*) for the conclusion alone and sometimes (*b*) for the entire mental product, comprehending the conclusion and the data. The datum or data from which the conclusion is drawn constitute the *premise or premises*, and the result arrived at is known as the *conclusion*. Thus, in the second sense of the term 'Inference', it stands (*a*) sometimes for the premise or premises and the conclusion taken together, and (*b*) sometimes for the conclusion alone.

Similarity is the ground of all inference.

From mere difference we can infer nothing.

It may be mentioned in this connection that similarity is the ground of all inference—whether deductive, inductive, or analogical. (*Vide* Chap. II, § 4.) From mere difference we can never infer anything. If, for example, we know that A is different from B, and B different from C, we can never infer any relation—whether of agreement or disagreement—between A and C. So, there must always be a bond of similarity to justify an inference in any case. In inductive inference, for example, we pass from some similar instances to a general law covering all such instances. In deduction, likewise, we apply a general law to a particular case on the ground of similarity between them ; and in analogy too we proceed from one instance to another on the strength of similarity, more or less fundamental

and prominent. Thus, as Bain observes, "Reasoning, in every form, supposes the operation of Similarity—the assimilating of one thing to some other thing." (*Logic*, I, p. 8.)

In the case of finite intelligence, Inference is essential to a knowledge of the distant, the past, and the future.

§ 2. **Importance of Inference.** The importance of Inference in a finite rational constitution can never be over-estimated. To an omniscient being, no doubt, there is no necessity of inference, since the past, the present, and the future, the near and the distant, are alike present before his mind. But, to such finite intelligence as we possess, inference is imperatively necessary. If we are to form expectations and arrive at an estimate of distant and remote events, we must have recourse to inference. When, for instance, we wish to determine the relative magnitudes of two buildings or rooms, it is not possible for us to place the two side by side and thus to observe their relative sizes. We are driven to employ a third object, say a cubit or a foot, to measure both and thus to determine their relative dimensions through this medium. Similarly, we cannot directly observe whether, say, there will be rain this afternoon or there was Frederick the Great or Akbar. We can only infer these through certain signs, natural or artificial (such as historic testimony). And, if man lives very little in the present, if most of his interests are centred in the past, the future, and the distant, the importance of inference and its scope in human life must indeed be pronounced to be very great.

**§ 3. Classification of Inferences.** Inferences may broadly be divided into two main classes, Inductive and Deductive. Analogical inference, in which we proceed from one case to another similar to it, is usually regarded as allied or ancillary to Induction. (*Vide* Book III.) We may, therefore, provisionally classify inferences thus :—

General classification of Inferences.

- Inference
  - Deductive
    - Immediate
      - from a Term.
      - from a Proposition.
    - Mediate
      - Syllogistic
        - Pure.
        - Mixed.
      - Non-Syllogistic (*e. g.*, Mathematical).
  - Inductive.

We shall consider Induction in Book III ; and so we shall restrict our inquiry to the exposition of the different forms of Deductive Inference in the rest of this Book.

*Points of difference.*

**§ 4. Deductive and Inductive Inference.** Inferences may at the outset be divided into two main classes—Deductive and Inductive. There are two main points of difference between deductive and inductive inference :—(1) In deductive inference, the conclusion is *not more* general than the data or premises. For example, when we argue thus—'All men are mortal' ; 'Kings are men', therefore 'Kings are mortal'—we get an instance of deductive inference. When, however, the conclusion is more general than the data or premises, the inference is known as 'inductive.' For example, when we conclude that all men are mortal from particular instances of mortality observed, say, in some twenty or thirty cases of

(1) In Induction the conclusion is more general than the data, while in deduction it is not more general.

men, we get an illustration of inductive inference. (2) Deductive inference aims at formal truth or self-consistency, while inductive inference aims at material truth or conformity to facts. (*Vide* Chap. I, § 9.) We shall at the outset confine our attention to deductive inference, considering induction later on.

(2) Induction aims at material truth, while Deduction, at formal.

We should bear in mind that the conclusion in deductive inference should never be more general than the data ; it may be either less general or equally general. In the example given above, we find that the conclusion, 'Kings are mortal,' is less general than the premise 'All men are mortal.' And generally the conclusions in Deduction are so. But cases may be cited when the conclusion and premises are all equally general, *e.g.*,

All three-sided figures are trilateral,
All triangles are three-sided,
∴ All triangles are trilateral ;
or, Snowdon is not so high as Mount Everest,
Snowdon is the highest mountain in England,
∴ The highest mountain in England is not so high as Mount Everest.

This form of deduction has sometimes been called **Traduction**.

In Immediate Inference, the conclusion follows from a term or a single premise; while in Mediate

**§ 5. Immediate and Mediate Inference.** Deductive inference may again be subdivided into immediate and mediate, according as the conclusion follows from a single term or proposition, or from more than one proposition. When, for example, we conclude that 'Some

animals are quadrupeds' from the proposition 'All quadrupeds are animals' we get an instance of immediate inference. As an example of mediate inference, we may mention the following—'All material bodies have weight'; 'Pens are material bodies'; therefore 'Pens have weight'. We shall first examine immediate inference and then proceed to the study of the different forms of mediate inference.

Inference, it follows from more than one premise.

It may be mentioned in this connection that immediate inferences which are mere developments out of a single proposition already accepted are sometimes known as **Eductions.** These include such forms as Conversion, Obversion, Contraposition, and Inversion.

Eduction.

Dr. Bain refuses to recognise immediate inference as inference proper. Referring to the different forms of immediate inference, he observes, "In none of these cases is there Inference properly so called, that is to say, the transition from a fact to some different fact; there is merely the transition from one wording to another wording of the same fact." (*Logic*, I, p. 108.) It may, however, be said in defence of Immediate Inference that even here something is made explicit which was implicit before, and so the mind arrives at a truth which was previously not known to it.

Dr. Bain denies that Immediate Inference is a real inference; but here also there is advance in knowledge.

## CHAPTER X.

### IMMEDIATE INFERENCE.

Two kinds of Immediate Inference:

**§ 1. Different Kinds and Forms of Immediate Inference.** Immediate inference is of two kinds according as the conclusion follows (*a*) from a term or (*b*) from a proposition.

**(*a*) Inference from a term**

(*a*) The first kind of immediate inference is illustrated when we deduce a proposition from a single term, such as 'All men are rational' or 'All men are animals' from the term 'man.' It is apparent that the conclusion in this kind of immediate inference is always a verbal proposition. We predicate in the conclusion what is contained in the connotation of the given term.

**and (*b*) inference from a proposition.**

(*b*) The second kind of immediate inference is illustrated when we deduce a proposition from another proposition, such as—'All men are mortal', therefore 'No immortal beings are men'. This kind of immediate inference assumes different forms, the principal of which are (1) Conversion, (2) Obversion, (3) Contraposition, (4) Inversion, (5) Opposition, (6) Subalternation, (7) Change of Relation, (8) Modal Consequence, (9) Inference by Complex Conception, and (10) Inference by Added Determinants.

**Different forms of the latter.**

Let us consider these different forms of Immediate Inference one by one.

§ 2. **Conversion.** Conversion may briefly be defined as the legitimate transposition of the subject and the predicate of a proposition. In converting a proposition we make the original subject the predicate of the conclusion and the original predicate the subject, the quality remaining the same, and no term being distributed in the conclusion which was not distributed in the premise. The proposition to be converted is called the *convertend*, and the conclusion arrived at is called the *converse*. The rules of conversion are :—(1) The subject and the predicate of the convertend become respectively the predicate and the subject of the converse ; (2) the quality of the convertend and the converse must be the same ; in other words the converse of an affirmative proposition is affirmative, and that of a negative proposition is negative ; and (3) no term should be distributed in the converse which was not distributed in the convertend. The third rule of conversion follows from the very nature of deductive inference. We have seen that in deductive reasoning the conclusion can never be more general than the datum or data. If so, then, no term which was undistributed in the premise can be distributed in the conclusion ; for, to distribute a term which was not distributed in the premise is to take more in the conclusion than what was given in the premise. It should, however, be distinctly borne in mind that there is no fallacy in taking a term as undistributed in the conclusion which was distributed in the premise. There is no

Conversion is the legitimate transposition of terms in a proposition.

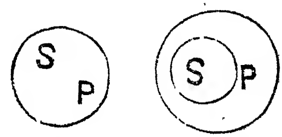
The rules of conversion.

fallacy in taking less, but there is fallacy in taking more, in the conclusion than what is given in the premise. Let us now see the conclusions which follow from the conversion of **A**, **E**, **I**, and **O** propositions. We may determine the result in two ways :—( 1 ) by applying the rules laid down above, and ( 2 ) by comparing the diagrams representing the convertend.

(1) The converse of **A** is **I**.

The converse of A is I. (Conversion by limitation.)

The convertend being affirmative, the converse must be so (Rule 1) ; so the converse cannot be **E** or **O**. The converse can neither be **A**. If the converse be A, the predicate of the convertend would be distributed in the converse, contrary to rule 2. Thus, the converse of A must be **I** : 'All S is P, when converted, becomes 'Some P is S.' This may also be proved by diagrams thus. The given proposition is represented by the following diagrams :—



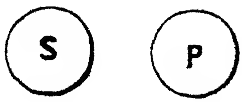

From the first diagram we may get the conclusions 'Some P is S' and 'All P is S.' But from the second diagram we get the conclusion 'Some P is S.' So, the common conclusion which can be drawn from both the diagrams representing an **A** proposition is 'Some P is S' (**I**).

It may be mentioned in this connection that in the case of a singular proposition, whose subject and predicate are co-extensive in extent, it is permissible to infer **A** instead of **I** by conversion.

Thus, 'Mount Everest is the highest mountain in the world,' 'The Viceroy of India is the Chancellor of the Calcutta University,' 'John is the only son of Jones' may be simply converted, **A** being inferred from **A**.

The converse of E is E. (Simple conversion.)

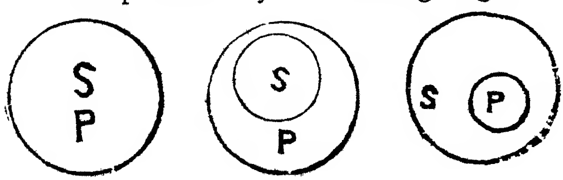
(2) The converse of **E** is **E**. 'No S is P' when converted becomes 'No P is S.' All the rules of conversion are satisfied here. The converse is negative, and the convertend was so; the subject and the predicate have been transposed; and the terms S and P, which are distributed in the converse, were also distributed in the convertend. This also may be proved by diagrams. 'No S is P' may be represented by the following diagram :—

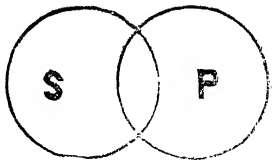



From this diagram follows 'No P is S,' which is the converse of the given proposition, as proved before.

The converse of I is I. (Simple conversion)

(3) The converse of **I** is **I**. 'Some S is P' when converted becomes 'Some P is S.' No term is here distributed in the converse, and none were distributed in the convertend. The converse is affirmative, and the convertend was also the same; and the subject and the predicate have been transposed. This may also be proved by diagrams. 'Some S is P' is represented by the following diagrams:—

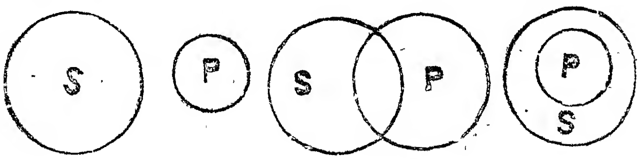





From the second and fourth diagrams we get the conclusion 'Some P is S' and 'Some P is not S'; but from the first and third diagrams the conclusion 'Some P is not S' cannot be drawn. The common conclusion which follows from all the diagrams is, therefore, 'Some P is S,' which is the converse of the given proposition.

**O cannot be converted.**

(4) 'O' cannot be converted. If we take the proposition 'Some *S* is not *P*,' we find that we cannot arrive at a conclusion by conversion. According to the rules, the subject and the predicate are to be transposed and the quality should remain the same. Thus, the converse of 'O' should be negative. But in such a case, the predicate of the converse (*i.e.*, *S*) becomes distributed, while the term is not distributed in the convertend. If, therefore, any conclusion is drawn, we violate the third rule given above. This may also be proved by diagrams. An 'O' proposition may be represented by the following diagrams :—




2 3

From the first diagram the conclusions which follow are 'Some *P* is not *S*' and 'No *P* is *S* ;' but none of

these conclusions can be drawn from the third diagram. Again the conclusions which can be drawn from the third diagram are 'All *P* is *S*' and 'Some *P* is *S*'; but none of these conclusions follow from the first diagram. We see, then, that no common conclusion can be drawn from all the diagrams representing an 'O' proposition. Thus, 'O' cannot be converted.

Conversion by negation is not properly conversion.

Some logicians convert 'O' by a process called *conversion by negation*. 'Some *S* is not *P*' is thus converted into 'Some not-*P* is *S*'. The given proposition is first reduced to the affirmative form by the transference of the negative particle to the predicate. The given proposition thus becomes 'Some *S* is not-P.' This proposition being I can be converted into an I proposition as shown above. The converse thus becomes 'Some not-*P* is *S*.'

It is doubly objectionable.

This process of converting an 'O' proposition is however doubly objectionable: (1) The converse is here affirmative while the convertend is negative, contrary to the rules of conversion. (2) Again, the subject of the converse is the contradictory of the original predicate, which also is not justified by the rules. Thus, an 'O' proposition cannot really be converted.

Conversion of hypothetical propositions.

In converting hypothetical propositions, we should remember that they are always affirmative and that their quantity is determined by the quantity of the antecedent. For example, 'In all cases, if *S* is *T*, *P* is not *Q*', when converted, becomes 'In some cases, if *P* is not *Q*, *S* is *T*.' Those who hold

that hypothetical propositions, like categoricals, may be negative, would take the converse of the proposition to be 'In all cases, if $P$ is $Q$, $S$ is not $T$.' (*Vide* Chap. VII, § 4.)

Distinction between simple conversion and conversion by limitation.

We have seen that the converse of **E** is **E** and that of **I** is **I**. In these two cases the converse and the convertend are both of the same type, universal or particular. This form of conversion is known as **Simple Conversion**. When, however, we convert an **A** proposition, we get an **I**. In this case, the converse is particular though the convertend is universal. This is known as **conversion by limitation or per accidens**

Simple and easy as Conversion is, we yet find even educated men not infrequently committing fallacies under this head. People at times imagine that to write in an illegible and hasty manner or to reply to a letter in a slip-shod fashion indicates exalted rank, since men of rank are often known to write in this way. But though men of position may out of necessity write thus, we cannot infer by conversion that 'whosoever writes in this manner is a man of position.' I remember a gentleman, finding another careful in his speech, asking him whether he was a Brahmo. Now, it may be true that all Brahmos are cautious in this respect; but we cannot infer from it that all who are so cautious are Brahmos. Such fallacies illustrate that, even in immediate inference, conclusions are not always patent; and so the view of Bain that it is not

properly an inference, but a mere verbal transformation, is not tenable. ( *Vide* Chapter IX, 5.)

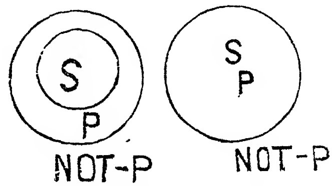
**§ 3. Obversion, Permutation, or Æquipollence.** The proposition to be obverted is known as the obvertend, while the conclusion arrived at by obversion is known as the obverse. In obverting a proposition, we are to take the contradictory of its predicate as the predicate of the conclusion and its subject as the subject,and then we are to change the quality of the proposition. Thus,if the obvertend be affirmative, the obverse must be negative; and if the obvertend be negative, the obverse must be affirmative. Obversion is ultimately based on the Principles of Contradiction and Excluded Middle : the affirmation of a quality and the denial of its contradictory, or the denial of a quality and the affirmation of its contradictory are logical equivalents. As Kanada says , विरोध्यभूतं भूतस्य, or "A non-existent contradictory is a mark of the existent." (*Vaiseshika Aphorisms*, Gough's Edition, p. 84.) In obversion the quality is changed to neutralize the negation introduced into the predicate. By double negation the import of a proposition is at times strengthened. Let us now see the conclusions which we get by obverting the propositions **A**, **E**, **I**, and **O**.

Obversion is double negation by changing the quality of the given proposition and substituting for its predicate its contradictory.

(1) The obverse of **A** is **E**. 'All S is P' when obverted becomes 'No S is not-P.' Here we have taken the contradictory of the original predicate as the predicate of the obverse, the subject remaining the same; and we have changed the quality:

The obverse of A is E.

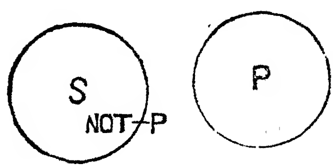
the obvertend is affirmative while the obverse is negative. This can also be proved by diagrams. The proposition 'All S is P' may be represented by the following diagrams :—




Not-P represents the space outside P, *i. e.*, everything else than P. If we compare S and not-P, we find that the whole of S is outside the whole of not-P in both the diagrams. In other words the conclusion is 'No S is not-P.'

The obverse of E is A.

(2) The obverse of **E** is **A**. 'No S is P' when obverted becomes 'All S is not-P. Here the contradictory of the original predicate is the predicate of the obverse, the subject remaining the same; and the obverse is affirmative while the obvertend is negative. This may also be proved by diagrams. The proposition 'No S is P' is represented by the following diagram :—

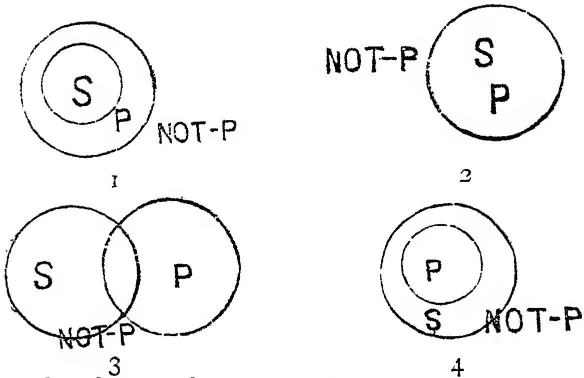



Here we see from the diagram that the whole of S is included in not-P. In other words, the obverse of 'No S is P' is 'All S is not-P.'

The obverse of I is O.

(3) The obverse of **I** is **O**. 'Some S is P' when obverted becomes 'Some S is not not-P.' Here the contradictory of the original predicate is taken as the predicate of the obverse,

the subject remaining the same; and the quality of the proposition is changed from affirmative to negative. This may also be proved by diagrams. The proposition 'Some S is P' is represented by the following diagrams:—



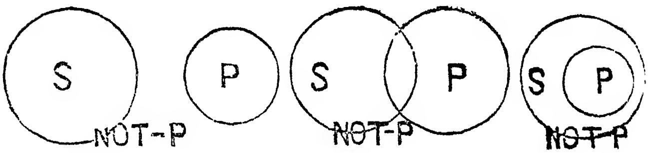

From the first and second diagrams we get the conclusion 'No S is not-P.' But this conclusion does not follow from the third and fourth diagrams, as in these a part of S is included in not-P. But the common conclusion which follows from all these diagrams is 'Some S is not not-P.' In the first two diagrams 'No S is not-P' is true; and therefore 'Some S is not not-P' is also true. The affirmative form 'Some S is not-P', though true in the third and fourth diagrams, does not hold good in the first two diagrams. Hence we see that the common conclusion justified by all the diagrams is 'Some S is not not-P'.

**The obvers of O is I.**

(4) The obverse of **O** is **I**. The proposition 'Some S is not P' when obverted becomes 'Some S

is not-P'. Here the contradictory of the original predicate is taken as the predicate of the obverse, the subject remaining the same ; and the quality of the proposition is changed from negative to affirmative.

This may also be proved by diagrams. The proposition 'Some S is not P' is represented by the following diagrams :—




From the first diagram we get the conclusion 'All S is not-P' ; but this conclusion does not follow from the second and third diagrams, where a part of S (*i.e.* that part which is included in P) is outside not-P. The common conclusion, therefore, justified by all the diagrams, is 'Some S is not-P.'

**Obversion hypothetical propositions.**

As hypothetical propositions are always affirmative, they cannot properly speaking be obverted. We may, however, perform a process analogous to obversion by introducing the two negatives into the consequent, the relation between the antecedent and consequent being always one of dependence. Thus, 'If S is T, P is Q' may be obverted into 'If S is T, P is not not-Q. Similarly,' the obverse of 'If S is T, P is not Q' is 'If S is T, P is not-Q'. These forms are also obtained by those who hold that hypothetical propositions having negative

consequents are negative ; but the validity of such a position may be questioned. (*Vide* Chap. VII, § 4.)

Material Obversion

Bain describes a process, called by him **Material Obversion**, by which we can pass, on the ground of experience, from one proposition to another having for its subject the contrary of the original subject and for its predicate the contrary or contradictory of the original predicate. Thus, from 'Warmth is agreeable' we pass to 'Cold is disagreeable' ; from 'War is productive of evil' to 'Peace is productive of good.' "Experience," says Bain, "teaches us that in an actual state of pleasurable warmth, the sudden change to cold is also a change to the disagreeable. Whenever an agent is giving us pleasure in act, the abrupt withdrawal of that agent is a positive cause of pain. On the faith of this induction, we can obvert materially a large number of propositions regarding pleasure and pain, good and evil. If the sight of happy beings gives pleasure, we may infer, not by formal implication, but by material or real inference, that the sight of unhappy beings gives pain. The inference is a consequence of the laws of our sensibility. While the sight of happy beings is giving us actual pleasure, any sudden withdrawal or disturbance of that sight is a painful shock or revulsion." (*Logic*, I, p. 112.) It may be remarked, however, that such a process can scarcely be described as immediate inference, far less as obversion. Such inferences are really deductions from generaliza-

is not properly a form of obversion.

tions proved by experience. And Bain himself practically admits this when he says—"On the faith of this induction, we can obvert materially a large number of propositions regarding pleasure and pain, good and evil."

Contraposition is conversion of the obverse of a proposition.

§ 4. **Contraposition.** Contraposition is that form of immediate inference in which we take, in the conclusion, the contradictory of the original predicate as the subject and the original subject as the predicate, changing the quality and quantity also if necessary. When we contrapose an affirmative proposition, we get a negative conclusion; and when we contrapose a negative proposition, we get an affirmative conclusion. We should also observe the rule that no term should be distributed in the conclusion which was not distributed in the premise. The conclusion arrived at by contraposition is called the *Contrapositive.*

It is a compound form of immediate inference.

Contraposition is really a compound form of immediate inference, involving both obversion and conversion, If, for example, we obvert a given proposition and then convert the obverse, we really contrapose the premise, as will be seen from the examples given below.

The contrapositive of A is E.

(1) The contrapositive of **A** is **E**. 'All S is P' when contraposed becomes 'No not-P is S.' Here we have taken the contradictory of the original predicate as the subject of the conclusion, and the original subject as the predicate. We have also changed the quality of the proposition from affir-

mative to negative ; and no term is distributed in the contrapositive which was not distributed in the proposition contraposed. This may also be proved by diagrams. The conclusion may also be established by reference to obversion and conversion thus :—

(A) All S is P ;

(E) ∴ No S is not-P (obverse) ;

(E) ∴ No not-P is S (converted obverse or contrapositive).

The contrapositive of E is I.

(2) The contrapositive of E is I. 'No S is P,' when contraposed, becomes 'Some not-P is S.' The rules of contraposition given above are all satisfied here ; and the conclusion may also be proved by diagrams. It may be justified by the double process of obversion and conversion thus :—

(E) No S is P ;

(A) All S is not-P (obverse) ;

(I) ∴ Some not-P is S (converted obverse or contrapositive).

The contrapositive here cannot possibly be an **A** proposition. When we obvert E, we get **A** ; and we know that the converse of **A** is not **A** but **I**. Hence the contrapositive of E is I.

I cannot be contraposed.

(3) The proposition I cannot be contraposed. This is apparent from the rules of contraposition given above. The contrapositive of I proposition must be negative according to the rules. But we know that a negative proposition distributes its predicate. Thus, the subject of the premise becomes distributed in the conclusion, without being

distributed in the premise itself. Hence an **I** proposition cannot be contraposed. This can also be illustrated by the double method thus—

(**I**) Some S is P ;

(**O**) ∴ Some S is not not-P (obverse).

The obverse of the given proposition being '**O**,' it cannot be converted ; and so an **I** proposition cannot be contraposed. This can also be proved by diagrams.

The contrapositive of O is I.

(4) The contrapositive of **O** is **I**. 'Some S is not P' when contraposed becomes 'Some not-P is S.' The rules of contraposition mentioned above are all satisfied here ; and the conclusion can also be established by diagrams. This may also be proved by the double method thus :—

(**O**) Some S is not P ;

(**I**) ∴ Some S is not-P (obverse ) ;

(**I**) ∴ Some not-P is S (converted obverse or contropasitive).

The converted obverse of a proposition should be distinguished from its obverted converse.

We should remember in this connection that the contrapositive of a proposition is its converted obverse and not the obverted converse. That the converted obverse and the obverted converse of a proposition are entirely distinct may be illustrated by reference to an **A** proposition thus ;—

(*a*) (**A**) All S is P ;

(**E**) ∴ No S is not-P (obverse) ;

(**E**) ∴ No not-P is S (converted obverse)....(I)

(*b*) (**A**) All S is P ;

(**I**) ∴ Some P is S (converse) ;

(O).∴Some P is not not-S (obverted converse).(2) The conclusions arrived at in (*a*) and (*b*) are quite distinct. So the converted obverse is not the same as the obverted converse.

Contraposition of hypothetical propositions.

The conversion and obversion of hypothetical propositions will enable the student to understand their contraposition. Properly speaking, hypothetical propositions cannot be contraposed, for they are always affirmative. We may, however, perform a process analogous to contraposition by introducing the two negatives into the antecedent and the consequent and then transposing their position consistently with the fundamental rule for the distribution of terms in deduction. Thus, 'If S is T, P is Q' may be contraposed into 'If P is not Q, S is not T.' Similarly, from 'In all cases if there is the sun, there is light', 'In all cases if a man is honest, he is respected', we may infer by contraposition 'In some cases if there is not light, there is not the sun,' 'In some cases if a man is not respected, he is not honest.' (*Vide* Chapter XII, § 2.)

Inversion is a form of inference in which the contradictory of the original subject is the subject and the original predicate or its contradictory is the predicate. It is a compound

§ 5. **Inversion.** It is a form of immediate inference in which the original predicate or its contradictory is affirmed or denied of the contradictory of the original subject. Inversion, like contraposition, is a compound form of immediate inference, involving both conversion and obversion. The proposition to be inverted is known as the Invertend; and the conclusion arrived at is known as the Inverse. Inversion consists in taking the contradictory of the original subject as the

form of immediate inference.

subject of the conclusion and either the original predicate or its contradictory as the predicate ; the quantity is changed from universal to particular. Inversion is of two distinct forms, known as (*a*) Partial and (*b*) Full or Complete. (*a*) In the case of *Partial Inversion* the predicate of the inverse is the same as that of the invertend. (*b*) In *Complete Inversion*, on the other hand, the predicate of the inverse is the contradictory of the original predicate. To arrive at the inverse of a proposition we should go on applying the principles of conversion and obversion, until we arrive at the desired result. We shall see that only A and E propositions can be inverted. Let us, therefore, determine the inferences which follow from the different kinds of propositions, A, E, I, and O.

Two forms of Inversion: (*a*) Partial: and (*b*) Complete.

Only A and E can be inverted.

The complete inverse of A is I, and its partial inverse is O.

(1) A. All S is P.

Let us begin by obverting the given proposition and see whether any inverse can be reached.

∴ No S is not-P (by obversion) ;... ... (1)

∴ No not-P is S (by contraposition) ; ... (2)

∴ All not-P is not-S (by obversion of (2)) ; (3)

∴ Some not-S is not-P (by converting (3)) ; (4)
(*Complete Inverse*)

∴ Some not-S is not P (by obverting (4)).
(*Partial Inverse.*)

If, however, we begin with converting an 'A' proposition, we find that we cannot get an inverse. It may be illustrated thus :—

(A) All S is P ;

(I) ∴ Some P is S (by conversion) ; .... ... (1)

(O) ∴ Some P is not not-S (by obverting (1));(2)

But 'O' proposition cannot be converted; so we cannot arrive at an inverse.

(2) Let us try to invert an 'E' proposition. Let us begin with obversion.

The complete inverse of E is O, and its partial inverse is I.

(E) No S is P; ... ... ... (1)

(A) ∴ All S is not-P (by obverting (1)); ... (2)

(I) ∴ Some not-P is S (by converting (2)); (3)

(O) ∴ Some not-P is not not-S (by obverting (3)). ... ... ... ... (4)

An 'O' proposition cannot be converted; so we cannot proceed any further.

We see, then, that we do not get an inverse, if we begin with obversion. Let us see now whether we can get an inverse if we begin with conversion.

(E) No S is P; ... ... ... (1)

(E) ∴ No P is S (by converting (1)); ... (2)

(A) ∴ All P is not-S (by obverting (2)); ... (3)

(I) ∴ Some not-S is P (by converting (3)) (4)
*(Partial Inverse)*.

(O) ∴ Some not-S is not not-P (by obverting (4))
*(Complete Inverse.)*

(3) Let us now try the I proposition.

I cannot be inverted.

(I) Some S is P; ... ... ... (1)

(O) ∴ Some S is not not-P (by obverting (1)...(2)

But (2) cannot be converted.

Let us see if we can get any inverse by beginning with conversion.

(I) Some S is P; ... ... ... (1)

(I) ∴ Some P is S (by converting (1)); ... (2)

(O) ∴ Some P is not not-S (by obverting (2))..(3)
But (3) cannot be converted.

Thus, we see that 'I' cannot be inverted, whether we begin with obversion or conversion.

O cannot be inverted.

(4) Let us see if O can be inverted.

(O) Some S is not P ; ... ... (1)
(I) ∴ Some S is not-P (by obverting (1)). (2)
(I) Some not-P is S (by converting (2)); ... (3)
(O) Some not-P is not not-S (by obverting (3)). ... ... ... ... (4)
But (4) cannot be converted.

Thus, we do not get any inverse of O if we begin with obversion. Let us see whether any conclusion follows if we begin with conversion But here, at the outset, we find that we cannot proceed, for the given proposition being 'O' cannot be converted. Thus, we see that O proposition cannot be inverted.

The above results can be established also by diagrams.

Conversion, Obversion, Contraposition, and Inversion compared.

If we compare Inversion with the preceding forms of inference, we find that in inversion the subject in the conclusion is the contradictory of the original subject, while in obverson the subject is the same as the original subject. In conversion the subject of the conclusion is the predicate of the original proposition ; and in contraposition the subject is the contradictory of the original predicate. O proposition cannot be converted ; I cannot be contraposed ; and O and I cannot be inverted.

§6. **Opposition.** The different forms of opposition have already been explained in Chapter VIII. Let us study here the rules regulating the inference of one proposition from another in these different forms.

*In contrary opposition*, the truth of one implies the falsity of the other, but not conversely.

(1) **Contrary Opposition** is illustrated in the case of A and E. In contrary opposition the truth of one implies the falsity of the other, but not conversely. If 'All S is P' be true, then, the whole of S being included in P, 'No S is P' must be false. Similarly, if 'No S is P' be true, then, the whole of S being outside the whole of P, 'All S is P' must be false. But, if 'All S is P' be false, it merely implies that the whole of S is not included in P. From this it does not follow that the whole of S is outside the whole of P, for a part may be inside and a part outside. Similarly, from the falsity of 'No S is P' we cannot infer the truth of 'All S is P.'

(2) In *subcontrary opposition*, the falsity of one implies the truth of the other, but not conversely.

(2) **Subcontrary Opposition** is illustrated in the case of I and O. In subcontrary opposition, the falsity of one proposition implies the truth of the other, but not conversely. (The rule is just the reverse of what is found in contrary opposition.) If 'Some S is P' be true, it merely implies that at least one S is P, and it may or may not be true that 'All S is P.' Hence, some S is not P may be false or may be true. Similarly, if 'Some S is not P' be true, 'Some S is P' is doubtful. If, however, 'Some S is P' be false, then it follows that not a single S is included in P. Thus, 'No S is P' is true; and therefore, 'Some S is not P' is much more true.

Similarly, if 'Some S is not P' be false, 'All S is P' is true, and so 'Some S is P' is still more true.

(3) In *contradictory opposition* the truth of one implies the falsity of the other, and *vice versa*.

(3) **Contradictory Opposition** is illustrated in the relation of A to O and of E to I. 'All S is P' and 'Some S is not P,' 'No S is P' and 'Some S is P' are contradictorily related. In contradictory opposition the truth of one implies the falsity of the other, and *vice versa*. If, for example, 'All S is P' be true, 'Some S is not P' must be false. 'All S P' implies that every S is included in P; and so not a single S is found outside P. Thus, 'Some S is not P' must be false. Similarly, if 'All S is P' be false, it implies that all S is not included in P. It follows, then, that at least one S is outside P; and so 'Some S is not P' is true. Similarly the other cases may be proved. It may be mentioned in this connection that, as in the other forms of inference, so here, a conclusion drawn may be established by comparison of diagrams.

In *subalternation*, if the universal is true, the particular is also true, but not conversely; while if the particular is false, the universal is also false, but not conversely.

§7. **Subalternation.** Subalternation, as we have seen, is the relation existing between two propositions which have the same subject and predicate, but differ in quantity alone. Subalternation is illustrated in the relation of 'A to I' and of 'E to O.' 'All S is P' and 'Some S is P,' and 'No S is P' and 'Some S is not P' are related to each other by way of subalternation. In subalternation, if the universal be true, the corresponding particular must be true; but if the particular be true the corresponding universal will be doubtful. If, however, the universal be false, the particular will be

doubtful; but if the particular be false, the corresponding universal must necessarily be false. If, for example, 'All P is S' is true then evidently 'Some S is P' is much more true; but if 'Some S is P' is true, it does not follow therefrom that 'All S is P' is true; it is doubtful—it may or may not be true. Similarly the other cases may be proved.

Summary of results.

The results of opposition and subalternation may be tabulated thus:—

| *Datum.* | *Inference.* |
|---|---|
| "A"—true....... | "E"—false (contrary); "I"—true (subaltern); and "O"—false (contradictory). |
| "A"—false...... | "E"—doubtful (contrary); "I"—doubtful (subaltern); "O"—true (contradictory). |
| "E"—true....... | "A"—false (contrary); "I"—false (contradictory); "O"—true (subaltern). |
| "E"—false...... | "A"—doubtful (contrary); "I"—true (contradictory); "O"—doubtful (subaltern.) |
| "I"—true....... | "A"—doubtful (subaltern); "E"—false (contradictory); "O"—doubtful (subcontrary). |
| "I"—false...... | "A"—false (subaltern); "E"—true (contradictory); "O"—true (subcontrary). |
| "O"—true....... | "A"—false (contradictory); "E"—doubtful (subaltern); ""I—doubtful (subcontrary). |
| "O"—false...... | "A"—true (contradictory); "E"—false (subaltern); "I"—true (subcontrary). |

Change of Relation is the legitimate transformation of a proposition of one kind of relation to one of a different kind.

**§8. Change of Relation.** Change of Relation is that form of inference in which we pass from a proposition of one relation to a proposition of a different kind of relation. When, for example, we infer a hypothetical from a categorical, or a categorical from a hypothetical, a hypothetical from a disjuctive or a disjunctive from hypotheticals, we find this form of inference illustrated.

(*a*) A categorical changed into a hypothetical.

(*a*) **Inferring a Hypothetical from a Categorical :—**

To draw such an inference we must remember that the antecedent of a hypothetical proposition corresponds to the subject of a categorical one, and the consequent corresponds to the predicate. We should also remember that the quantity of a hyyothetical proposition is determined by the quantity of its antecedent. If the given proposition is 'All S is P', the hypothetical inference from it is 'In all cases if S is, P is.' Similarly, from 'No S is P' we infer "In all cases if S is, P is not'. From 'Some S is P we infer 'In some cases if S is, P is, and from 'Some S is not P' we infer 'In some cases if S is, P is not.'

The negation of a categorical proposition is transferred to the predicate of a hypothetical which, as we have seen, is always affirmative in character. (*Vide* Chap. XII, § 2, footnote.)

(*b*) A hypothetical changed into a categorical.

(*b*) **Inferring a Categorical from a Hypothetical :—**

From the hypothetical proposition 'In all cases if S is T, P is Q' we get the categorical inference

'All cases of S being T are cases of P being Q.' Similarly, from 'In all cases if S is, P is not' we get the categorical inference 'No case of the existence of S is a case of the existence of P'. From 'In some cases if S is, P is' we get 'Some cases of the existence of S are cases of the existence of P'; and from 'In some cases if S is, P is not'' we get 'Some cases of the existence of S are not cases of the existence of P.' The negation in the consequent of a hypothetical is transferred to the copula of the corresponding categorical. (*Vide* Chap. XII, § 2, footnote.)

(*c*) A disjunctive changed into hypotheticals,

Two different Views.

(*c*) **Inferring Hypotheticals from a Disjunctive :—**

We have already read that according to some writers the members of a disjunctive proposition are mutually exclusive : they are like two contradictory propositions, the truth of one implying the falsity of the other, and *vice versa*. This is the view supported by Ueberweg. According to this view, from the disjunctive proposition 'S is either P or Q' we get the following hypotheticals :—

'If S is P, S is not Q' ;
'If S is Q, S is not P' ;
'If S is not P, S is Q' ;
'If S is not Q, S is P'.

According to Mill, however, the members of a disjunctive proposition are like two subcontrary propositions, the falsity of one implying the truth of the other, but not conversely. Thus, from the

above disjunctive we get, according to this view, only two hypotheticals namely—

"If S is not P, S is Q";
"If S is not Q, S is P".

We have seen that categorical propositions may be inferred from hypotheticals. Hence we can derive also catigorical propositions from a disjunctive.

(*d*) **Inferring a Disjunctive from Hypotheticals** :—

Hypotheticals changed into a disjunctive.

As explained above, hypothetical propositions are involved in a disjunctive. When, therefore, such hypothetical propositions are given, we can infer from them a disjunctive proposition. If, for example, the following hypotheticals be given, namely—

(1) 'If S is P, S is not Q',
(2) 'If S is Q, S is not P',
(3) 'If S is not P, S is Q',
(4) 'If S is not Q, S is P',

we can infer the disjunctive 'S is either P or Q'. The inference may be proved thus:—In (3) 'If S is Q' be false, its contradictory 'S is not Q' must be true. Therefore, from (4) 'S is P' must be true. (*Vide* Chap. XII, § 2.) Again, in (4) if 'S is P' be false, its contradictory 'S is not P' must be true. Therefore, from (3) 'S is Q' is true. We see then that 'S is P' and 'S is Q' are so related that if one be false, the other is true; and thus they can be the members of a disjunctive proposition in Mill's sense of a disjunctive. From (3) and (4), therefore, we can infer the disjunctive 'Either S is P or S is Q', *i.e.*, 'S is either P or Q'.

Again, if 'S is P' be true, from (1) we find that 'S is not Q' must be true; and hence its contradictory 'S is Q' in (2) must be false. Similarly, if 'S is Q' be true, it follows from (2) that 'S is not P' must also be true; and hence its contradictory 'S is P' in (1) must be false. Thus, from (1) and (2) we find that if 'S is P' be true, 'S is Q' must be false; and if 'S is Q' be true, 'S is P' must be false. But we also know from (3) and (4) that, of 'S is P' and 'S is Q', if one be false, the other must be true. Thus, from the four hypothetical propositions given above, we find that 'S is P' and 'S is Q' are so related that the truth of one implies the falsity of the other, and *vice versa*. Therefore, these can be the members of a disjunctive proposition in Ueberweg's sense; and we get the disjunctive 'Either S is P or S is Q,' *i.e.*, S is either P or Q.

From a single hypothetical a disjunctive may be inferred in Mill's sense of it.

We see, then, that a disjunctive proposition may be inferred from two or more hypotheticals. Let us see whether a disjunctive proposition can be inferred from a single hypothetical. If we take the hypothetical proposition to be 'If S is P, S is Q', we find that its contrapositive is 'If S is not Q, S is not P'. If 'S is Q' be false, its contradictory 'S is not Q' must be true; and from the latter proposition we find that 'S is not P' must also be true (*Vide* Chap. XII, § 2.) Again, if 'S is not P' be false, its contradictory 'S is P' must be true; and from the former proposition we find that 'S is Q' must also be true. Thus, 'S is Q' and 'S is not P'

are so related that if one be false, the other must be true. They may, therefore, be the members of a disjunctive proposition in Mill's sense of a disjunctive ; and so we get the disjunctive inference 'Either S is Q or S is not P' from the hypothetical 'If S is P, S is Q.' It is not possible, however, to infer from a single hypothetical a disjuuctive proposition in Ueberweg's sense of it.

Truth of less certainty follows from that of greater certainty, but not conversely ; and falsity of greater certainty follows from that of less certainty, but not conversely.

§ 9. **Modal Consequence.** This form of Inference enables us to proceed from propositions of one form of modality to propositions of different forms of modality. Propositions, according to modality, are divided into Necessary, Assertory and Probable forms. Two rules guide us here in arriving at conclusions : (1) From the truth of greater certainty, we can infer the truth of less certainty ; but not conversely. Thus, from the truth of a Necessary proposition, we can infer the truth of the corresponding Assertory and Probable forms ; and from the truth of an Assertory, we can infer the truth of the corresponding probable form, but not the reverse. (2) From the falsity of less certainty, we can infer the falsity of greater certainty, but not conversely. Thus, from the falsity of a Probable proposition, we can infer the falsity of the corresponding Assertory and Necessary ; and from the falsity of an Assortory proposition we can infer the falsity the corresponding Necessary ; but not *vice versa.* If, for example, it be false that 'Darkness *may* be light' it is evidently also false that 'Darkness *is* light' or 'Darkness

*must be* light'. Similarly, if it be false that John is present here, then it is also false that 'John must be present here'. But the proposition 'John *may be* present here' is not necessarily false. For though John is not actually present here, yet the possibility of his presence is not excluded by the Assertory proposition.

§ **10. Inference by Complex Conception.** Inference by Complex Conception consists in making both the subject and the predicate of a proposition parts of a more complex notion; provided the relation between the subject and the predicate is not substantially altered. For example, from the proposition 'Dog is an animal', we can infer that 'The skeleton of a dog is the skeleton of an animal'. But in such cases we cannot draw an inference in which the meanings of the subject and the predicate are not affected in a parallel way. For example, from the proposition 'Students are men' we cannot infer that 'A majority of students constitute a majority of men', for what may be a majority in relation to students may be a minority in relation to men.

The subject and the predicate of a proposition may become parts of a more complex conception when their meanings are affected in a parallel way.

§ **11. Inference by Added Determinants.** Inference by added determinants consists in drawing a conclusion from a single proposition by qualifying both the snbject and the predicate of the premise in the same way. For example, from the proposition 'Tables are material bodies' we infer that 'Round tables are round material bodies'. But here too we should be careful to notice that

The subject and the predicate of a proposition may be qualified by epithets which affect their meanings symmetrically.

the meanings of the subject and the predicate are affected in a parallel way ; otherwise the inference will not be valid. For example, from the proposition 'Ant is an animal' we cannot conclude that 'A large ant is a large animal'. For, though an ant my be large with regard to its own kind, it cannot be called large in the scale of animals.

**§12. Hints for Working Out Exercises.** (1) Before drawing immediate inferences from a proposition, it should be reduced to the logical form ; and logical form, as mentioned above, is determined by meaning and not simply by the mode of expression.

(2) The process of inference should, in every case, be named ; and in the case of several inferences drawn from a premise, their order and connection should be indicated.

(3) The premise being assumed as true, only those inferences which follow from such an assumption need be drawn. For example, in the case of Opposition or Modal Consequence, the inferences which follow from the supposition of falsity need not be given, unless specially required by the character of a question.

## Illustrations.

1. Convert and obvert (*a*) Not a few members were present, (*b*) John is the only son of Jones, (*c*) Graduates alone are eligible for the post.

(*a*) *Not a few members were present*

= Many members were present :

Some members were present. (I).

Its converse—Some who were present were members.

Its obverse—Some members were not not-present (or absent).

(*b*) *John is the only son of Jones*

=No not-John is the son of Jones···(1);

or, The son of Jones is John...(2) [*Vide* Chap. VII, § 8.]

The converse of (1) No son of Jones is not-John.

The obverse of (1)...All not-John is not-son-of-Jones.

The converse of (2)...John is the son of Jones.

The obverse of (2) . The son of Jones is not not-John.

(*c*) *Graduates alone are eligible for the post*

=No non-graduates are eligible for the post;...(1) or, All who are eligible for the post are graduates...(2).

The converse of (1) No persons eligible for the post are non-graduates.

The obverse of (1) All non-graduates are not-eligible-for-the-post.

The converse of (2) Some graduates are eligible for the post.

The obverse of (2) No persons eligible for the post are non-graduates.

2. Draw possible inferences from (*a*) All S is P, (*b*) No S is P, (*c*) Some S is P, and (*d*) Some S is not P.

(*a*) *All* S *is* P......(1)

Converse of (1)···Some P is S....(2)

Obverse of (1)...No S is not-P....(3)

Converse of (3)...No not-P is S....(4) [Contrapositive of (1).]

Obverse of (4)...All not-P is not-S....(5)

Converse of (5)...Some not-S is not-P....(6) [Complete Inverse of (1).]

Obverse of (6)...Some not-S is not P....(7) [Partial Inverse of (1).]

Obverse of (2)...Some P is not not-S....(8)

By Subalternation...Some S is P....(9)

By Contradiction...Some S is not P (false)....(10)

By Contrariety...No S is P (false)....(11)

By Change of Relation...In all cases if S is, P is. ...(12)

By Modal Consequence...All S may be P.....(13)

" All S must be P (doubtful)....(14)

(*b*) *No* S *is* P....(1)

Converse of (1) No P is S....(2)

Obverse of (1) All S is not-P....(3)

Converse of (3)...Some not-P is S....(4) [Contrapositive of (1).]

Obverse of (4)...Some not-P is not not-S....(5)

Obverse of (2)···All P is not-S....(6)

Converse of (6)···Some not-S is P....(7) [Partial inverse of (1).]

Obverse of (7)...Some not-S is not not-P....(8) [Complete Inverse of (1).]

By Subalternation...Some S is not P....(6)

By Contradiction...Some S is P (false)....(10)

By Contrariety...All S is P (false)....(11)

By Change of Relation...In all cases if S is, P is not....(12)

By Modal Consequence...No S may be P;...(13)

" No S must be P (doubtful)....(14)

(*c*) *Some* S is P....(1)

Converse of (1) Some P is S....(2)

Obverse of (1) Some S is not not-P....(3)

Obverse of (2) Some P is not not-S....(4)

By Subalternation...All S is P (doubtful)....(5)

By Contradiction...No S is P (false)....(6)

By Subcontrariety...Some S is not P (doubtful). ...(7)

By Change of Relation...In some cases if S is, P is....(8)

By Modal Consequence...Some S may be P; ...(9)

" Some S must be P (doubtful)....(10)

(*d*) *Some* S *is not* P......(1)

Obverse of (1) Some S is not-P. ...(2)

Converse (2) Some not-P is S. ...(3) [Contra positive of (1).]

Obverse of (3) Some not-P is not not-S...(4).

By Subalternation...No S is P (doubtful)...(5)

By Contradiction...All S is P (false)...(6)

By Subcontrariety...Some S is P (doubtful)....(7)

By Change of Relation ...In some cases if S is, P is not. ...(8)

By Modal Consequence···Some S may not be P; ...(9)

Some S must not be P (doubtful). ...(10)

*N. B.* Inferences by Complex Conception and Added Determinants have not been given above, as they are best intelligible in the case of concrete examples.

## § 13. Exercises.

1. Indicate the character and importance of inferential knowledge. Classify Inferences, with examples.

2. Distinguish between (1) Deductive and Inductive, (2) Mediate and Inmediate, Inference. Name the different forms of Inmediate Inference.

3. Define Conversion and state its rules. Distinguish between Simple Conversion and Conversion *per accidens*. Show that O cannot be converted.

4. Distinguish Obversion, Conversion, and Inversion. Show that Contraposition is a double inference involving a two-fold process.

5. Distinguish between (1) Complete and Partial Inversion and (2) the Converted Obverse and the Obverted Converse of a proposition.

6. Distinguish between Contrary and Contradictory Opposition. Show that in refuting an opponent, the contradictory is of greater service than the contrary.

7. Frame concrete examples in A, E, I, and O, and draw all posible inferences from them.

8. Draw as many inferences as you can from the truth or falsity of each of the following propositions

(1) All that is agreeable is not wholesome.

(2) Not one of the crew survived.

(3) Few can do this difficult work

(4) In summer the days are generally hot.

9. Show in a tabular form what conclusions you are entitled to draw from the truth or falsity of **A**, **E**, **I**, or **O**.

10. Test the folowing :—

(*a*) Sweet is agreeable : therefore, Bitter is painful.

(*b*) All men are not wise : therefore, All wise beings are not men.

(*c*) A lawyer is a man : therefore, A good lawyer is a good man.

(*d*) My watch was found under your pillow. So the presumption is against you ; you might have stolen the watch. You are, then, a thief. You must, therefore, be punished.

(*e*) This table is red : therefore, It is not yellow.

(*r*) Some A is B : therefore, Some not-A is not-B.

(*g*) In all cases if there is the sun there is heat : therefore, In all cases if there is heat, there is the sun.

(*h*) Englishmen are Europeans : therefore, A majority of Englishmen is a majority of Europeans.

11. Deduce hypothetical and categorical propostitions from the following :

(*a*) A is either B or C.

(*b*) Margaret is either fond or foolish.

(*c*) James is either here or at Calcutta.

# CHAPTER XI.

## SYLLOGISMS.

§ **1. Definition and Characteristics of Syllogism.** Having considered the different forms of Immediate Inference, let us now proceed to study the form of Mediate Deductive Inference known as the Syllogism. The Syllogism may be briefly defined as a form of Mediate Deductive Inference in which the conclusion follows from two premises, the conclusion being not more general than the data. For example, 'All created beings are subject to death,' 'Men are created beings'; therefore 'They are subject to death.' Here the conclusion 'Men are subject to death' follows, not from either of the premises taken separately, but from both of them taken together. And the conclusion is evidently not more general than the data or premises.

Definition of Syllogism.

*Characteristics*:

On an examination of the nature of Syllogistic Inference, we find that it is characterized by three marks :—

(1) The conclusion follows from the two premises taken together;

(1) The first characteristic of Syllogism is that the conclusion follows, as indicated above, from two premises taken together, and not from any one of them separately. In the above illustration, for example, we may know that 'All created beings are subject to death' without know-

ing that men are so. That 'Men are mortal' can be inferred only when it is known that they are created beings *and* that such beings are liable to death. By this mark a Syllogism is to be distinguished from Immediate Inference, in which the conclusion, as we have seen, follows only from one premise.

(2) it can never be more general than the data ;

(2) The conclusion of a Syllogism can never be more general than the premises. This feature of Syllogistic Inference follows from its nature as Deductive Reasoning. We have already read that the conclusion in Deductive Reasoning can never be more general than the data. Syllogism, being but a form of Deductive Inference, bears that mark.

(3) it necessarily follows from the premises ; but its material truth depends on theirs.

(3) The conclusion of a Syllogism is said to be hypothetically necessary in character. In other words, the conclusion, though inevitably following from the data, is not of necessity materially or actually true. The truth of the conclusion depends upon the truth of the data. We have already read that the data in Deductive Logic are assumed as true ; we have no right to question their validity. Thus, the conclusion of a Syllogism is materially true, provided its premises are so.

A syllogism is composed of three propositions : major premise, minor premise, and conclusion.

§ **2. Analysis of Syllogism.** A syllogism, when analysed, is found to be made up of parts indicated by different names. Let us explain their meanings by reference to an example : 'All M is P', 'All S is M' ; therefore 'All S is P'. Here the subject of the conclusion, namely S, is called the

*Minor Term* ; and the predicate of the conclusion, namely P, is called the *Major Term*.* The premise in which the minor term, or the subject of the conclusion, occurs is called the *Minor Premise* ; and the premise in which the major term, or the predicate of the conclusion, occurs is called the *Major Premise.* In the above example, 'All S is M' is the minor premise, as the minor term S is present in it; and 'All M is P' is the major premise, as it contains the major term P in it. It is usual, but not necessary, to place the major premise first and the minor premise next. And thus every Syllogism is composed of two premises—major and minor—and the conclusion.

When we examine a syllogism, we find that it

* When the conclusion is an A proposition (which is the type of syllogistic reasoning), its predicate, taken in denotation, is wider or major, while its subject, narrower or minor. The middle term in such a case is of medium or intermediate extent. For example,

All men are mortal;
Kings are men :
∴ Kings are mortal.

Here 'mortal', the predicate of the conclusion, has the widest denotation, including 'men' and 'kings' ; 'men' is next in order of extent ; while 'kings' has the least denotation of all the three. Moreover, we should remember that, in all practical argumentation, we start from the conclusion, and then advance reasons in the form of premises to justify it. Thus, ordinarily we say—'Kings are mortal', because 'They are men', and 'Men are mortal.' Hence in bestowing names, we start from the conclusion—the problem (Gr. *problema*, a question proposed for solution) or thesis in dialectic, the question at issue.

is made up of three terms, one of which occurs in both the premises, but is absent from the conclusion. This term is known as the *Middle Term.* In the example given above, 'M' is the middle term. The other two terms, with each of which the middle term is compared in the premises, are known as the *Extremes.* In the above example, 'S' and 'P' are the extremes, which have been compared with the middle term in the premises. In the major premise the major term is compared with the middle, and in the minor premise the minor term is compared with the middle; and, as the result of this comparison with the common medium, we establish a relation between the extremes themselves in the conclusion. Thus, 'All M is P'; 'All S is M'; therefore 'All S is P.' The extremes, as indicated above, are the minor and major terms. We should remember, in this connection, that the middle term of a syllogism can easily be recognised by the fact that it is present in both the premises, but absent from the conclusion. And its reason is to be found in the fact that the middle term is the term which enables us to find out a relation between the extremes, so that when a relation is discovered, that is, the conclusion is arrived at, the function of the middle term is over, and so its presence is no longer required in the conclusion. Thus, in every valid syllogism, there are altogether three terms, each term occurring twice.

It is composed of three terms: minor, middle, and major.

The middle term enables us to find out a relation between the extremes—the major and the minor term.

§ **3. The Greek and the Hindu Syllogism.** We have already seen (*Vide* Chap. I, § 14)

that logic as a science was cultivated in ancient times by the Greeks and the Hindus; and we find striking points of similarity between their treatment of the subject. The points of similarity are no less prominent in the case of the syllogism. There are the same three terms, major (*sadhya* or *vyapaka*), middle (*hetu* or *vyapya*), and minor (*paksha*); and the conclusion (*nigamana* or *anumiti*) in both the systems follows necessarily from the two premises—major (*vyapti*) and minor (*upanaya*). But, inspite of these common features, we find important points of difference. If, to Aristotle, a syllogism consists only of three parts—the two premises and the conclusion, to Gotama, it is made up of five *avayava* or members, *viz.*, (1) *Pratijna* or a statement of the question, (2) *Hetu* or reason, (3) *Udaharana* or example, (4) *Upanaya* or application, and (5) *Nigamana* or conclusion. And it has often been urged that the *Nyaya System* of Gotama is marked by undue prolixity: if three members can explain a syllogism, what is the necessity of five? To understand Gotama's five-membered syllogism aright, we should remember that it does not exactly correspond to the Aristotelian syllogism. The latter aims at mere formal consistency, without inquiring into the truth of the premises, but the former aims at real truth and so tries to prove the (universal) major premise by reference to examples, the minor being a fact of perception. *Anumana* or Inference is concerned with *pramana* or proof which is but an instrument

*Points of similarity*: (1) There are three terms essential to a syllogism, in which (2) the conclusion follows necessarily from the premises.

*Points of difference*: (1) There are three parts in the Greek form, while, five, in the Hindu.

(2) The Greek form aims at formal consistency, while the Hindu form, at real truth.

of *prama* or truth ; and truth or accurate knowledge lies in attributing to a thing what really is in it.* Again, Inference is taken to be of two principal forms according as its end is to convince either (*a*) one's own self or (*b*) others. (*a*) In inference for one's own self (*svarthanumana*) an explicit statement of the first two members may not be so essential to reasoning itself, they being naturally suggested to the mind ; but, (*b*) in the case of inference for others (*pararthanumana*), an explicit enumeration of all the five members is necessary for the ready acceptance of a syllogism. We should remember in this connection the time when Gotama wrote and the end of his logic. He wanted to prove spiritual truth to men who were more or less infected with heresy and influenced by scepticism. So, it was but fair to state at the outset what was going to be proved and to briefly mention the reason which suggested the conclusion. And, when by way of afterthought reasons were explicitly formulated, they were supported by instances or examples, as otherwise the abstract propositions might be disputed. Thus, we get at the outset an enthymeme referring to (1) the conclusion to be established and (2) the reason suggesting the conclusion. (*Vide* Chap. XIII, § 1.) Without such an initial statement or declaration of what is to be proved, an abrupt

(3) The Hindu form recognises a difference between inference for one's own self and that for others, which the Greek form does not recognise.

The Hindu form renders a syllogism more acceptable to others.

* प्रमायाः करणं प्रमाणं । प्रमा च यथार्थानुभवः ।
तद्वति तदवगाहित्वं यथार्थं । (*Siddhanta Manjari.*)

commencement with premises may seem strange, if not quite unintelligible, to others. And then an attempt is made formally to state (3 the major and (4) minor premises and finally (5) to establish the conclusion, broached at the outset. In fact, the initial statement is called *pratijna* or promise, as it implies an undertaking to establish conclusively what is but mentioned in the beginning.

An illustration.

In the light of the preceding remarks let us try to understand the Hindu syllogism. (1) The initial statement, for example, may be 'The mountain is fiery'. This is what is spontaneously suggested by the sight of a mountain; and the ground of suggestion is discovered to be (2) that the mountain smokes. These two members alone may suffice as an abbreviated or condensed argument in evident or undisputed intances. And we find, accordingly, such enthymematic forms often used in *sutras* and commentaries in simple cases. But when a point which is not quite clear has to be established, recorse must be had to the other members, and the argument must be set forth in full. Thus, in the above example, it is urged (3) that 'whatever smokes is fiery, such as a culinary hearth'. The reference to the familiar example of a 'culinary hearth' has the effect of rendering the universal proposition at once acceptable. The *onus* of proof to the contrary thus falls on the opponent. The universal proposition, which forms the major premise (*vyapti*), expresses inseparable connection between smoke and fire, or,

as it is put by the Nayaik, 'smokiness is pervaded by fieriness', *i. e.*, wherever there is smoke, there is fire. Hence we find that the pervading quality is called *vyapaka* (here 'fieriness'), which is the major term, while what is pervaded is called *vyapya* (here 'smokiness'), which is the middle term. Now, in the light of this general rule, we examine the particular case. We observe that (4) the mountain possesses fire-pervaded smoke. This is the fourth member of the syllogism, implying the application of a general rule to a special case. Such application indicates that we are weighing the significance of a sign to arrive at a conclusion ; and hence it has been called by Nayaiks *linga-paramarsa* or 'pondering of a sign'. As a result of this consideration we arrive at (5) *anumiti* or conclusive knowledge that 'The mountain is fiery', *i. e.*, 'it is a volcano', which was but surmised at the outset.

The Hindu form is useful for the practical attainment of truth, while the Greek form is suited to the elucidation of the nature of the syllogism as a mode of deductive inference.

From the above account it is clear that the Hindu syllogism indicates the most natural and cogent form of argument to arrive at truth in any particular case. The Greek form, on the other hand, represents the most cogent form of argument in the abstract, which examines merely the validity of inference in any particular case without any reference to the truth of the premises. The one may be described as the most effective form of practical syllogism to prove a point in dispute ; and the other as a theoretical study of the conditions of valid argument, when we pass from a general rule to a special case. For scientific

purposes it is, no doubt, convenient and useful to isolate factors for distinct treatment which naturally go together. Thus, we may dwell on light apart from sound, or on sound apart from resistance, though actually these qualities often go together. That three members of a syllogism suffice for scientific interest is admitted even by some Hindu logicians. It is mentioned, for example, in the *Vedanta Paribhasa*—"An argument consists of several members. And *real* members there are only three; assertion, reason, proposition; or proposition, assumption, and deduction. Not five; for three are sufficient to exhibit the pervading rule and its two members, the other two can, therefore, be dispensed with." In discussing syllogisms, therefore, we shall confine our attention to the Greek three-membered form, as it is best suited to elucidate the conditions of syllogistic inference in its abstract precision and fullness.

As our interest here is in the scientific study of the syllogism, we shall confine our attention to the Greek form.

§ 4. **Kinds of Syllogism.** We have seen that propositions are divided according to relation into categorical, hypothetical, and disjunctive, all of which may be employed in syllogistic arguments. Syllogisms have, accordingly, been divided into Pure and Mixed, according as their constituent propositions are all of the same relation or of different relations. For example, 'All men are mortal' 'John is a man,' therefore, 'John is mortal', is a pure syllogism of the categorical type, as all the constituent propositions are categorical in character. Similarly, 'If there is peace, there is

Syllogisms are divided into Pure and Mixed, according as they are composed of propositions of the same relation or of different relations.

prosperity'; 'If there is prosperity; there is strength', therefore, 'If there is peace, there is strength,' is a pure syllogism of the hypothetical type, as all the propositions are hypothetical in character. In the present chapter, we shall confine our attention to the consideration of these two forms of Pure Syllogism; and in the next, we shall examine the different forms of Mixed Syllogism.

In this chapter we shall study Pure Syllogisms.

§ 5 **Figures of Syllogism**. Figure is the form of a syllogism as determined by the position of the middle term in relation to the major and the minor. Though every syllogism consists of three terms and three propositions, yet the relative position of the terms is not always the same in every syllogism. We should remember that of the two premises one is called the major and the other, the minor, according as it contains the major or the minor term, and also that the middle term is present only in the premises. The middle term may thus occupy four different places in different syllogisms. And these variations of syllogisms due to possible variations in the position of the middle term are known as figures. We, accordingly, get four figures of the syllogism. If S be the minor, M the middle, and P the major term, then the four figures may be represented thus :—

Definition of 'Figure.'

There are four figures.

| I. | II. | III. | IV. |
|---|---|---|---|
| MP ; | PM ; | MP ; | PM ; |
| SM : | SM : | MS : | MS : |
| ∴ SP. | ∴ SP. | ∴ SP. | ∴ SP. |

The first form given above is known as the first figure. In it the middle term is subject in the major and predicate in the minor premise. In the second figure, the middle term is predicate in both the premises. In the third figure, the middle term is subject in both the premises. In the last form (which is regarded as the fourth figure), the middle term is predicate in the major but subject in the minor premise.

We may remember the peculiarities of the different figures by bearing in mind that in the first figure the middle term comes first (*i.e.*, as subject) in the first or major premise; it comes next (*i.e.*, as predicate) in the next or minor premise. In other words, the middle term is subject in the major but predicate in the minor premise. In the second figure, the middle term comes second in both the premises, *i.e.*, it is predicate in both. The third figure is the reverse of the second; and the fourth is the reverse of the first.

If the distinction between the minor and the major term be overlooked, then there would be only three figures.

We should also note in this connection that we get four figures only when the distinction between major and minor terms, and therefore between major and minor premises, is observed. When that distinction is overlooked then the fourth and the first figure blend in one form and so we get only three figures.

Definition of 'Mood.'

§ 6. **Moods of Syllogism.** Mood is the form of a syllogism as determined by the quality and quantity of the constituent propositions or premises. We know that every syllogism is com-

posed of three propositions, namely two premises and a conclusion. And we also know that there are four kinds of propositions—namely A, E, I, and O—when we classify them by reference to quality and quantity. (*Vide* Chap. VII, § 8.) Now, the different syllogistic combinations of propositions of different quality or quantity give rise to various forms or modes of syllogism, technically called Moods. The term 'Mood' has been used in at least three different senses :—

'Mood' has been used in three senses :

(1) In the widest sense 'Mood' indicates the syllogistic forms as determined by the quality and quantity of all the constituent propositions, *viz.*, the premises and the conclusion.

(1) widest sense ;

(2) In a wider sense the term indicates the forms as determined by the quality and quantity of the constituent premises.

(2) wider sense ;

(3) In the narrow sense the term implies only the valid forms of syllogistic argument. Let us illustrate these remarks by reference to cases.

and (3) narrow sense.

Mood in the second sense is illustrated in the different combinations of premises as determined by quality and quantity: We thus get sixteen possible moods in each figure, which may be represented thus :—

In the wider sense, there are sixteen possible moods in each figure (and 64 in all).

| | | | |
|---|---|---|---|
| A A | E A | I A | O A |
| A E | E E | I E | O E |
| A I | E I | I I | O I |
| A O | E O | I O | O O |

If, however, we take 'Mood' in the widest sense, then each of the forms given above admits of four

In the widest sense there are sixty-four

possible moods in each figure (and 256 in all).

variations owing to the variation of the conclusion in respect of quality or quantity. For example, in the combination of premises AA, we get four distinct forms thus—

AAA
AAE
AAI
AAO

It is apparent from the preceding remarks that the number of moods in the second sense is 16 in each figure and 64 in all the figures; while in the first sense, the number is $16 \times 4$ or 64 in each figure, and 256 in all the figures. These different moods indicate but possible combinations of propositions in syllogistic forms, only 19 of which are valid; and 'Mood' in the narrow sense stands for these 19 valid forms. We shall use the term in the second or wider sense as implying possible combinations of premises varying in quality or quantity and determining a definite conclusion in certain cases.

In the narrow sense there are nineteen moods in all.

We shall use the term in the second or wider sense.

§ 7. **Tests of Syllogism.** The syllogistic argument when employed to establish a position may be either valid or invalid. All Syllogisms are not necessarily correct. We may, for example, argue—

Syllogisms may be either valid or invalid.

All men are mortal,
Poets are men,
∴ Poets are mortal;

or, we may argue

Poets are mortal,
Birds are mortal,
∴ Birds are poets.

In both the cases we may employ a syllogism, but the syllogism is not equally valid. Hence certain Tests are laid down by the application of which we can determine whether a syllogistic argument is valid or not. And ordinarily four tests are employed. These are :—

Validity is determined by four methods :

I. The use of *Diagrams* representing the premises of the syllogism to be tested.

(I) Diagrams ;

II. The use of the *General Syllogistic Rules* by the application of which we can determine whether an argument is correct or incorrect.

(II) Genera Syllogistic Rules ;

III. The *Special Rules* of the different (four) Figures.

(III) Special Rules of the Figures ;

IV. Aristotle's *Dictum* and *Reduction.*

and (IV) Aristotle's Dictum and Reduction.

Let us consider these tests one by one. We shall dwell in the next two sections on the two general tests, *viz.*, proof by Diagrams and General Syllogistic Rules, and shall explain the Special Rules in connection with the Figures to which they specially apply. The fourth test, *viz.*, Aristotle's Dictum and Reduction, we shall explain after the exposition of the other tests. Let us, therefore, first explain the method of determining the validity of syllogisms by Diagrams.

**§ 8. Diagrammatic Test of Syllogisms.** In testing syllogisms by diagrams we are to represent the premises by appropriate diagrams and combine them in order to see whether a common conclusion follows from all the combinations. If ommon conclusion can be drawn, the argument thenalid ; if not, it is invalid.

We are to combine the diagrams representing the premises and to see whether any common conclusion follows or not from all the combinations.

Two axioms employed :

Two axioms guide us here in determining whether a conclusion follows or not from all the combinations of diagrams. One of these axioms is applicable to syllogisms having affirmative premises, while the other to syllogisms having a negative premise. From two negative premises, *i.e.*, from mere difference, we can never infer anything. (*Vide Chap.* II, § 10 and Chap. IX, § 1.)

The two axioms are :—

(i) axiom for affirmative syllogisms ;

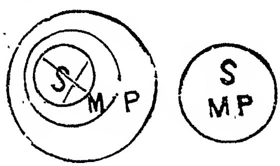
(i) Two circles coinciding with a third by any the same part coincide with each other by that part.

(ii) axiom for negative syllogisms.

(ii) Two circles of which one coincides and the other does not with a third by any the same part do not coincide with each other by that part.

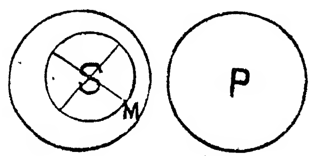
The axioms may be illustrated by the following diagrams :—

I




All M is P ;
All S is M :
∴ All S is P.

II




No M is P ;
All S is M :
∴ No S is P.

In the first case, the circles S, M, and P represent the three terms of the syllogism as they are related together in the premises. Here we find that the two circles S and P coincide with a third circle M by any the same part (namely S) ;

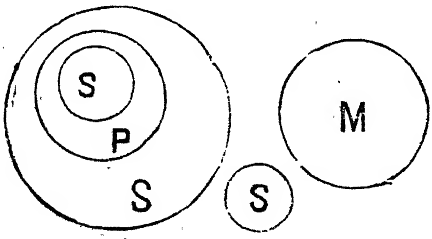
we can, accordingly, infer that S and P coincide with each other by that part, that is we can infer 'All S is P' or 'Some P is S.'

In the second case, the circles S, M, and P represent the terms of the negative syllogism* as they are related to each other in the premises. Here we find that, of the two circles S and P, one (namely S) coincides, while the other (namely P) does not coincide, with a third (namely M) by any the same part (the crossed portion). We can accordingly infer that these two circles S and P do not coincide with each other by that part, that is, we can draw the conclusion 'No S is P' or 'No P is S.'

When no axiom is applicable no conclusion follows.

We should remember in this connection that when neither of the above axioms is applicable to a syllogistic inference, the inference is to be held as fallacious. For example, no valid conclusion can be drawn when a syllogism is of the following form :—

No M is P ;
No S is M ;
∴ No S is P.




Here neither of the above axioms is applicable, and so the inference is incorrect.

* A negative syllogism is one having *a* negative premise, for no conclusion follows from two negative premises.

*General Syllogistic Rules* :

§ 9. **General Syllogistic Rules.** The validity of syllogistic inference can also be determined by certain general rules governing this form of inference. These are known as the *general syllogistic canons or rules*. Let us study these rules one by one.

I. There must be three terms.

**Rule I.** *Every syllogism must have three and only three terms.* If there be less than three terms, namely two, then we either get simply a proposition or we find an immediate inference. So there must be more than two terms in order to the presence of the mediate form of deductive reasoning. If, however, there be more than three terms, either there is no middle term, and so no conclusion can be drawn owing to the absence of a medium of comparison, or there is a train of syllogistic reasoning, *i.e.*, a combination of distinct syllogisms. For example, in the argument, 'All men are mortal' and 'Pankhas are extended,' no conclusion can be drawn because there is no common or middle term. Similarly, in the example—'All animals are mortal,' 'All men are animals,' 'Doctors are men,' ∴ 'Doctors are mortal'—we get no doubt more than three terms; but there is here not a single syllogism but a combination of two syllogisms. The argument may be analysed thus:—

(1) All animals are mortal,
All men are animals,
∴ All men are mortal;

(2) All men are mortal (the conclusion of the preceding syllogism),

Doctors are men :
∴ Doctors are mortal.

It is evident, therefore, that every syllogism must have only three terms—the extremes and the middle term—neither more nor less.

It should be remembered in this connection that the middle term should be used exactly in the same sense in both the premises. If the middle term be used in one sense in one premise and in a different sense in the other, then really there is no middle term, for the sense is different though the form is the same. We have already read that the character of a term is determined by reference to its sense and not its form. When, therefore, the middle term is used ambiguously, we get the fallacy of what is technically called the *fallacy of ambiguous middle.* And this fallacy, as indicated above, is but an aspect of the *fallacy of four terms.*

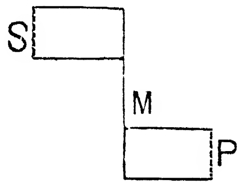
II. There must be three propositions.

**Rule II**, *Every syllogism must have three and only three propositions.* If there be less than three propositions, namely two, we get but a form of immediate inference, composed of a premise and a conclusion. If there be more than three, either some of the premises are superfluous or there is a combination of several syllogisms, giving rise to what is called a train of syllogistic reasoning as shown above. (*Vide* Chap. XIII, § 2 and § 3.)

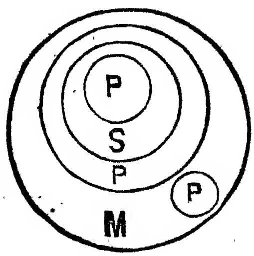
A Syllogism, then, can have neither more nor less than three propositions—one of which is the conclusion, revealing the relation discovered between the extremes, and the other two the premises indicating the relations in which the extremes stand to the middle term.

III. The middle term must be distributed at least once.

**Rule III.** *The middle term must be distributed at least once.* If the middle term be not distributed in either premise, then one part of the middle term may be compared with one extreme in one premise, and a different part may be compared with the other extreme in the other premise. For example, if the premises be 'All S is M' and 'All P is M,' then S may be compared with one part of M, while P with another part of it. Thus, the apparently middle term is not really so. In such a case, the middle term fails to perform its function as a medium of comparison; and hence no conclusion can be drawn, indicating the relation between the extremes. This may be illustrated by diagrams thus :—




All S is M ;
All P is M :
No conclusion.




Here no conclusion can be drawn showing a relation between the extremes, S and P. When this rule is violated

we commit an error, which is technically called the **fallacy of undistributed middle.**

IV. No term can be distributed in the conclusion without being distributed in the premise.

Rule IV. *No term should be distributed in the conclusion which was not distributed in a premise.* The truth of this rule follows from the very nature of deductive inference. We have read that in deductive reasoning the conclusion can never be more general than the data. Hence a term—major or minor—cannot be distributed in the conclusion without being distributed in the premise. If it be so distributed, then, contrary to the nature of deductive inference, we take more in the conclusion than what is given in the premise. The violation of this rule gives rise to the fallacy of what is technically called the **Illicit Process.** This fallacy assumes two forms according as the major or the minor term is distributed in the conclusion without being distributed in the premise. When the minor term is so distributed, the fallacy is called the fallacy of the *illicit process of the minor term* or more briefly the *illicit minor*; aud when the major term is so distributed the fallacy is known as the fallacy of the *illicit process of the major term* or simply the *illicit major*. As examples of these fallacies we may take the following :—

| (1) *Illicit minor.* | (2) *Illicit Major.* |
|---|---|
| All P is M ; | Some M is P ; |
| Some S is not M : | No S is M : |
| ∴ No S is P. | ∴ No S is P. |

In (1) S is distributed in the conclusion, being the subject of an universal proposition, while it is undistributed in the minor premise, where it is the subject of a particular proposition. In (2) P is distributed in the conclusion, being the predicate of a negative proposition, while it is undistributed in the major premise, where it is the predicate of an affirmative proposition.

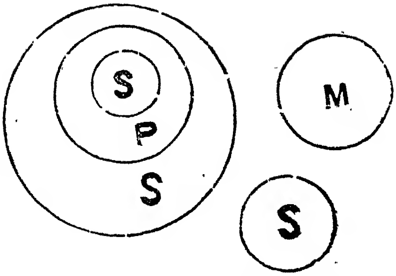
The converse of this rule is not true.

We should distinctly remember in this connection that *the converse of this rule is not true.* It is not true to hold that if a term be undistributed in the conclusion it must have been be undistributed in a premise or that if a term be distributed in a premise it must be distributed in the conclusion. We should remember that in deductive inference there is no fallacy in taking less in the conclusion than what is given in the premise ; it is objectionable only to take more.

V. Two negatives prove nothing.

**Rule V.** *If both the premises be negative, no conclusion follows.* A negative proposition shows that there is no connection between its terms. If both the premises be negative, then the middle term is not at all connected with either extreme. From the absence of any connection between the middle term and the extremes we can never infer any possible relation between the extremes themselves. They may or may not be connected with each other. When this rule is violated, there is the fallacy of negative premises. It may be illustrated by diagrams thus :

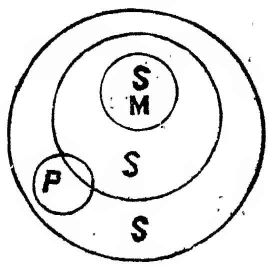
No M is P ;
No S is M :
No conclusion.




From the different positions of S we can never infer any uniform relation between S and P. Thus, in every valid syllogism, at least one of the premises must be affirmative.

VI. A negative premise must have a negative conclusion.

**Rule VI.*** *If either premise be negative, the conclusion must be negative.* According to the preceding rule, if one premise be negative, the other must be affirmative to justify a conclusion. Now, the affirmative premise expresses the presence of a connection between the middle term and one of the extremes; while the negative premise expresses the absence of a connection between the middle term and the other extreme. From the presence of connection in the one case and the absence of connection in the other, all that we can possibly infer is that there is no connection between the extremes themselves. In other words, the conclusion must be a negative proposition. It may be illustrated by diagrams thus :—




No P is M ;
All M is S :
∴ Some S is not P.

The only common conclusion justified by the different positions of S is that some S is outside P.

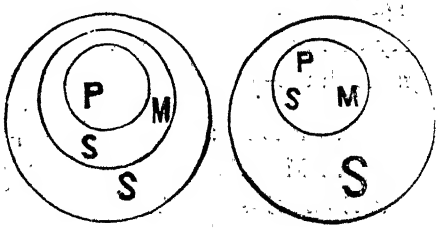
The converse of this rule is true.

We should remember in this connection that *the converse of this rule is true.* If the conclusion in any case be negative, then one of the premises must be negative, and the other, affirmative. A negative conclusion implies the absence of a connection between the extremes, which can never be inferred if both the premises express either the presence or the absence of connection between the middle term and the extremes. Only when one premise shows a connection between the middle term and an extreme and the other shows absence of such connection, can we possibly infer the absence of a connection between the extremes themselves, as in the example given above.

VII. Affirmative premises prove an affirmative conclusion.

Rule VII. *If both the premises be affirmative, the conclusion must be affirmative.* An affirmative proposition expresses the presence of a connection between its terms. When both the premises are affirmative, they express that there is a connection between the middle term and each of the extremes. From the presence of such a connection in both the cases, all that we can infer is that there is a connection between the extremes themselves. This may be illustrated by diagrams thus :—

All P is M ;
All M is S :
∴ Some S is P,
or All P is S.



The *converse of this rule is also true.* If the conclusion in any case be affirmative, then both the premises must be so. For, we have already seen that if one of the premises be negative, the conclusion must be negative. As, however, the conclusion is affirmative, neither premise can be negative, *i.e.*, both the premises must be affirmative.

The converse of this rule is true.

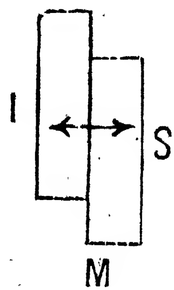
Rule VIII. *If both the premises be particular, no conclusion can be drawn.* If both the premises be particular, then the possible combinations are II, IO, OI, and OO, where the first vowel stands for the major premise and the second for the minor. In the combination II no term is distributed (for an I proposition does not distribute any term). The middle term, therefore, has not the chance of being distributed at least once in this combination of premises ; and if the middle term be not distributed at least once, the combination can never lead to a valid conclusion, there being the fallacy of undistributed middle. The combination OO may at once be rejected, as both the premises are negative ; and no conclusion can be drawn from two negative premises. In the combinations IO and OI, there is only one term distributed in each combination. The predicate of O, being the predicate of a negative proposition, is distributed, while its subject is undistributed ; and both the subject and the predicate of I proposition are undistributed. The term which is distributed in the premises must be the middle term, as otherwise there would be the fallacy of undistributed middle.

VIII. Two particulars prove nothing.

And no other term besides this is left distributed in the premises, which may possibly be distributed in the conclusion. But one of the premises in each of these combinations being negative (namely O), the conclusion must also be negative; and so its predicate, the major term, becomes distributed. But this term was not distributed in the premise. Hence there arises the fallacy of illicit process of the major term, when any conclusion is drawn from such combinations. We see, then, that no valid conclusion can be drawn from these two combinations, nor from the combinations II and OO. Thus, two particular premises do not justify any conclusion. In every valid syllogism, therefore, at least one of the premises must be universal.

Two particular premises may, however, lead to a conclusion, when the argument is in the third figure and the middle term stands, in each case, for more than half of its denotation.

It may be mentioned in this connection that two particular premises may lead to a conclusion when the argument is in the third figure and when the middle term in each case stands for more than half of its denotation. For example, when the premises are 'Most men are intelligent' and 'Most men are guided by self-interest', we can draw the conclusion that 'Some men guided by self-interest are intelligent' or 'Some intelligent men are guided by self-interest.' If M stands for 'men', I for 'intelligent', and S for 'guided by self-interest', then the relation of the terms may be diagrammatically represented as shown in this figure.



Most M being I and most M being S, a part of I is a part of S. Whenever more than half of the middle term is compared with each extreme, then there is some common portion of the middle term which may serve as the medium of comparison; and so, in such a case, we discover that one extreme is partially connected with the other. We must remember, however, that the argument must be in the third figure, as otherwise we have no means of knowing (unless we adopt Hamilton's doctrine of the quantification of the predicate) whether more than half of the middle term is taken in any case and so whether there is any common medium of comparison at all. (*Vide* Chap. I, § 7.)

IX. A particular premise must have a particular conclusion.

**Rule IX.** *If one of the premises be particular, the conclusion must also be particular.* If one premise be particular, the other must be universal to justify a conclusion (for, according to the preceding rule, no conclusion follows from two particular premises). If one premise be particular and the other universal, the possible combinations of premises would be **AI**, **AO**, **EI**, and **EO** *in any order.*

The combination **EO** in any order may be rejected at once, as both the premises are negative which can never justify a conclusion. In the combination **AI**, in any order, only one term, namely the subject of **A**, is distributed. This must, according to rule 3, be the middle term. Besides the middle term, therefore, no other term is distributed in the premises. Hence, no term can be distributed in the conclusion. (Rule 4.)

And, both the premises being affirmative, the conclusion must be affirmative. The conclusion, therefore, must be an I proposition, which is the only proposition which does not distribute any term. Thus, in the case of AI, in any order, the conclusion is I, *i.e.*, particular. In the combinations EI and AO, in any order, only two terms are distributed in each, namely the subject and the predicate of E in the combination EI in any order, and the subject of A and the predicate of O in the combination AO in any order. Of these two terms that are distributed in the premises, one must be the middle term (Rule 3); and besides the middle term only another term is left distributed in the premises which may possibly be distributed in the conclusion. But the conclusion in both the combinations must be negative (Rule 6); and so its predicate must be distributed. Therefore, the predicate of the conclusion must be that other term which was left distributed in the premises besides the middle term. The subject of the conclusion, therefore, cannot be distributed. In other words, the conclusion must be particular. Thus, in all cases if a premise be particular, the conclusion must be particular, when any conclusion can legitimately be drawn.

The converse of this rule is not true.

It should be remembered in this connection that the converse of this rule is not true. The conclusion may be particular when both the premises are universal. Even when a term is distributed in a premise, it may be undistributed in

the conclusion. There is, as mentioned before, no fallacy in taking less, there is fallacy only in taking more, in the conclusion than what is given in the premises.

It is evident from this rule that *if the conclusion in any case be universal, both the premises must be universal.* For, if a premise be particular, the conclusion must be particular. Hence, no premise can be particular when the conclusion is universal.

But a universal conclusion must have universal premises.

**Rule X.** *If the major premise be particular and the minor negative, no conclusion can be drawn.* If the minor premise be negative, the major must be affirmative (Rule 5) and the conclusion, negative (Rule 6). The major term thus becomes distributed in the conclusion, being the predicate of a negative proposition; but in the major premise the major term is not distributed, as the premise is both particular and affirmative. Thus, if any conclusion be drawn there would be the fallacy of illicit process of the major term. Hence, no conclusion follows from such a combination of premises.

X. A particular major and a negative minor prove nothing.

When we examine these rules we find that the first two rules are about the structure of the syllogism; the next two rules are about the distribution of terms; and the remaining rules refer either to the quality or quantity of the constituent propositions. Of the rules given above, the first six may be regarded as primary, while the last four as secondary, being mere deductions from the former. All the rules, however, are interconnected, they

being but different expressions of the laws of consistency explained in Chapter II. The principal syllogistic rules are thus indicated in the following lines :—

"Of terms have but three ; proposition as term ;
Distribute the Middle—in this be most firm ;
Distribute no term in Conclusion, beside,
Unless in a premise 'tis equally wide ;
One premise affirmative, this you must learn,
For negative premises nothing affirm ;
A negative head has a negative tail,
And the converse of this is of equal avail."

(*Questions on Logic by Messrs. Holman and Irvine*, p. 65.)

**§ 10. Determination of General Valid Moods.** Let us now examine the sixteen possible moods in each figure with a view to determine which of them may be valid when tested by Diagrams or by General Syllogistic Rules.

The Possible Moods, as mentioned above, are—

| | | | |
|---|---|---|---|
| AA | EA | IA | OA |
| AE | EE | IE | OE |
| A I | E I | I I | O I |
| AO | EO | IO | OO |

Of the sixteen possible moods in each figure, eight are rejected by the general syllogistic rules.

Of these, we reject EE, EO, OE, and OO, as both the premises are negative (Rule 5) ; and we also reject II, IO, and OI, as both the premises are particular (Rule 8). The combination IE is also invalid according to Rule 10. Thus, only eight moods—AA, AE, AI, AO, EA, EI, IA,

Thus AA

and OA—are left which may possibly be valid. We shall see that all of them are not valid in all the figures. Let us, therefore, proceed now to determine which of them are valid in which figure.

**AE, AI, AO, EA, EI, IA,** and **OA** remain to be tested in each figure.

*Moods of the First Figure :*

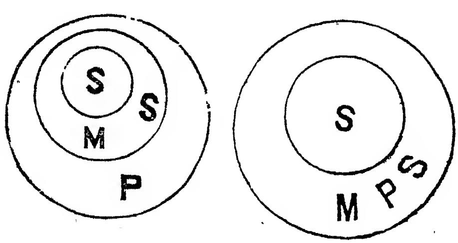
**§ 11. Valid Moods and Special Rules of the First Figure.** Let us test the eight remaining moods,. mentioned above, with a view to ascertain which of them are valid in this figure.

(1) AA is valid. (*Barbara.*)

(1) A A : All M is P ;
All S is M :
∴ All S is P.

Here the middle term is distributed in the major premise, being the subject of an A proposition. Both the premises being affirmative, the conclusian must also be affirmative. And if the conclusion be 'All S is P', there would be no illicit process (as S is distributed in the minor premise) nor any other fallacy. Thus, the mood A A leads to the conclusion A in the first figure. It is technically known as **Barbara**, in which the first vowel stands for the major, the second for the minor premise, while the third vowel stands for the conclusion.

The syllogism may also be tested by diagrams thus :—



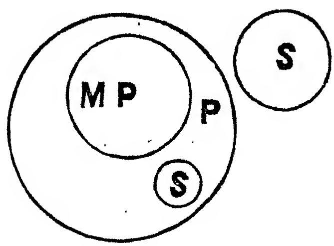
If we examine the combinations of diagrams representing the premises, we find that the common conclusion which follows from all of them is 'All S is P.'*

(2) AE is invalid. (Illicit major.)

(2) AE: All M is P ;
No S is M :
No conclusion.

Here one of the premises being negative, the conclusion must be negative, and its predicate the major term must be distributed. But the major term is not distributed in the major premise, being the predicate of an affirmative proposition. Thus, rule 4 is violated, giving rise to the fallacy of the illicit process of the major term, if any conclusion is drawn.

This may also be tested by diagrams thus :—




On examining the different combinations of diagrams representing the premises, we find that no common conclusion can follow with S, the minor term, as subject and P, the major term, as predicate. Hence the mood is invalid in the first figure.

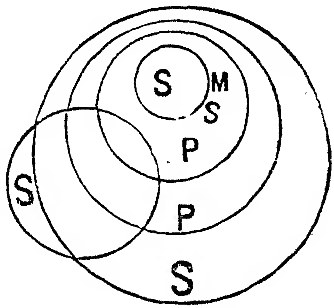
* It should be noted that in the syllogism as it is put, representing A A in the first figure, the conclusion must have S for its subject and P for its predicate, as otherwise the argument will be in a different figure or mood. If, for example, the conclusion be of the form 'Some P is S', which also would be valid, the argument will be in the fourth, instead of in the first, figure; then the mood will be AAI (*Bramantip*) instead of AAA (*Barbara*). The remark applies to all moods in all figures.

(3) **A I** : All M is P ;
Some S is M :
∴ Some S is P.

(3) **AI** is valid. (*Darii.*)

Here both the premises are affirmative, and so the conclusion must be affirmative. One of the premises is particular ; hence the conclusion must be so. Therefore, the conclusion must be both particular and affirmative, *i.e.*, an I proposition. As no term is distributed in the conclusion, there is no possibility of illicit process ; and the middle term is distributed in the major premise. So the valid conclusion is 'Some S is P.'

This may also be tested by diagrams. The diagrams representing the premises may be combined thus :—




The common conclusion which follows from all the positions of S and P is 'Some S is P.' Hence this is the valid conclusion in this case. This valid mood is technically known as **Darii.**

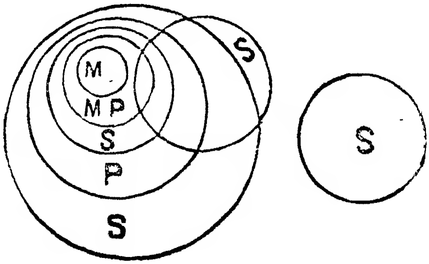
(4) **AO** : All M is P ;
Some S is not M :
No conclusion.

(4) **AO** is invalid. (Illicit major.)

Here one of the premises being negative, the conclusion must be negative ; and so its predicate, the major term P, becomes distributed. But P was not distributed in the premise, being the

predicate of an affirmative proposition. Thus, if any conclusion be drawn, there would be the fallacy of illicit process of the major term. Hence AO is not valid in the first figure.

This may be proved also by diagrams. The diagrams representing the premises may be combined thus :—




From all these positions of S and P no common conclusion can be drawn. Hence the mood AO is invalid in the first figure.

Having illustrated in the above cases the methods of testing syllogisms by the general syllogistic rules and diagrams, we shall, to avoid unnecessary prolixity, test the remaining moods by the general and special rules alone, examining them finally by Aristotle's Dictum and Reduction. The student should, however, draw the diagrams representing the premises and combine them in all possible ways to see whether any conclusion is justified by all of them. (*Vide* § 8 and Chap. VII, § 9.) In testing a mood by diagrams, care should be taken to draw all the possible combinations,

as otherwise the proof will be defective and so incorrect.

(5) EA : No M is P ;
All S is M :
∴ No S is P.

(5) EA is valid. (*Celarent*)

Here the middle term is distributed in the major premise, being the subject of an E proposition. One of the premises being negative, the conclusion must be negative. Both the premises being universal, the conclusion *may* be so. Therefore, the conclusion may be of the form E, 'No S is P.' In the conclusion the major and the minor term are distributed; and they are distributed in the premises. There is thus no illicit process. So the mood EA is valid in the first figure, leading to the conclusion E. The mood is technically known as **Celarent.**

(6) EI : No M is P ;
Some S is M :
∴ Some S is not P.

(6) EI is valid. (*Ferio.*)

Here the middle term is distributed in the major premise, being the subject of an E proposition. One of the premises being negative, the conclusion must be negative; and one of the premises being particular, the conclusion must be particular. Thus, the conclusion should be an O proposition of the form 'Some S is not P.' The major term is distributed in the conclusion and it is also distributed in the major premise. So there is no illicit process. The mood is, therefore, valid in the first figure, leading to the conclusion O ; and

it is technically known as **Ferio.** It may be proved also by diagrams.

(7) **IA** is invalid. (Undistributed middle.)

(7) **I A**: Some M is P;
All S is M:
No conclusion.

As the middle term is not distributed at least once, this combination does not yield a valid conclusion in the first figure. It involves the fallacy of undistributed middle. It may be proved also by diagrams.

(8) **OA** is invalid. (Undistributed middle.)

(8) **O A**: Some M is not P;
All S is M:
No conclusion.

The middle term in this combination is not distributed at least once. It, therefore, involves the fallacy of undistributed middle and cannot lead to a valid conclusion in the first figure. It may be proved also by diagrams.

If we gather the results of our examination of the moods, we find that only four of them are valid in the first figure, which are known as **Barbara, Celarent, Darii,** and **Ferio.**

The Special Rules of the First Figure

The *Special Rules* of the first figure are:—

(1) The major premise must be universal.

(2) The minor premise must be affirmative.

proved by the general syllogistic rules.

These two rules may be proved by the general syllogistic rules thus:—

(1) If the major premise be not universal, it must be particular. In that case the middle term would not be distributed in the major premise. To avoid the fallacy of undistributed middle, the

middle term must be distributed in the minor premise. But the middle term is predicate in the minor premise in the first figure; and only negative propositions distribute their predicate. The minor premise must, therefore, be negative; and consequently the major premise must be affirmative, and the conclusion negative. The conclusion being negative, its predicate, the major term, becomes distributed, though it was not distributed in the affirmative premise. Thus, there would be the fallacy of illicit major, if we suppose the major premise to be particular. The major premise, accordingly, must be universal, and not particular as supposed before.

(2) If the minor premise be not affirmative, it must be negative and so the major premise affirmative and the conclusion negative. The major term is thus distributed in the conclusion without being distributed in the premise, giving rise to the fallacy of illicit process of the major term. Our supposition, therefore, is false; and the minor premise is not negative, but affirmative.

Valid moods determined by the Special Rules.

We have read before that the validity of a syllogistic argument may be determined not merely by the general syllogistic rules but also by the special rules of the different figures. Let us see whether the valid moods can be determined, in the case of the first figure, by its special rules. The 16 possible moods are:—

| | | | |
|---|---|---|---|
| AA | EA | IA | OA |
| AE | EE | IE | OE |
| AI | EI | II | OI |
| AO | EO | IO | OO |

By applying the first rule we find the last eight moods to be invalid, as the major premise in all of them is particular.

Next, when we apply the second special rule, mentioned above, we find that the moods **AE**, **EE**, **AO**, and **EO** are invalid, in as much as the minor premise, in every one of them, is negative. Thus, only four moods are left—namely, **Barbara**, **Celarent**, **Darii**, and **Ferio**—which may be regarded as valid.

*Moods of the Second Figure*:

**§ 12. Valid Moods and Special Rules of the Second Figure.** Let us now examine the eight moods in the second figure, as we did in the first, with a view to determine which of them are valid in the second figure.

(1) **AA** is invalid. (Undistributed middle.)

(1) **A A** : All P is M ;
All S is M :
No conclusion.

Here no conclusion follows, as the middle term M is not distributed in either premise, being the predicate of an affirmative proposition. Thus, there is the fallacy of undistributed middle ; and the mood is invalid in the second figure. It may be proved also by diagrams.

(2) **AE** is valid. (*Camestres*.)

(2) **A E** : All P is M ;
No S is M :
∴ No S is P.

Here the middle term is distributed in the minor premise, being the predicate of a negative proposition. One of the premises being negative, the conclusion must be negative ; and both the

premises being universal, the conclusion *may be* universal. If the conclusion is 'No S is P', there is no illicit process, as both the extremes were distributed in the premises. Thus, the mood **AE** is valid in the second figure, leading to the conclusion **E**. It is technically known as **Camestres**, It may be proved also by diagrams.

(3) **A I** : All P is M ;
Some S is M :
No conclusion.

(3) **AI** is invalid. (Undistributed middle.)

This mood is evidently invalid in the second figure, as the middle term is not distributed at least once. It may be proved also by diagrams.

(4) **AO** : All P is M ;
Some S is not M :
∴ Some S is not P.

(4) **AO** is valid. (*Baroco*.)

One of the premises being negative, the conclusion must be negative ; and one of the premises being particular, the conclusion must be particular. So the conclusion must be an **O** proposition, that is, of the form 'Some S is not P'. The major term P, which is distributed in the conclusion, is also distributed in the premise. Thus, there is no illicit process. And the middle term is distributed in the minor premise, being the predicate of a negative proposition. Therefore, the mood **AO** is valid in the second figure, leading to the conclusion **O**. It is technically known as **Baroco**. It may likewise be proved by diagrams.

(5) EA is valid. (*Cesare.*)

(5) EA : No P is M ;
All S is M :
∴ No S is P.

The middle term is distributed in the major premise, being the predicate of a negative proposition. One of the premises being negative, the conclusion must be negative ; and both the premises being universal the conclusion *may be* universal. The conclusion, therefore, may be of the form 'No S is P'. There is no illicit process, in as much as the terms that are distributed in the conclusion were distributed in the premises. The mood EA, therefore, is valid in the second figure, leading to the conclusion E. It is technically called **Cesare.** It may be proved also by diagrams.

(6) EI is valid. (*Festino.*)

(6) EI : No P is M ;
Some S is M :
∴ Some S is not P.

The middle term is distributed in the major premise, being the predicate of an E proposition. One of the premises being negative, the conclusion must be negative ; and a premise being particular, the conclusion must also be particular. The conclusion, therefore, must be an O proposition of the form 'Some S is not P'. There is no illicit process as the major term P, which is distributed in the conclusion, was distributed in the premise. Thus, the mood EI is valid in the second figure, leading to the conclusion O. It is technically known as **Festino.** It may be proved also by diagrams.

(7) **IA** : Some P is M ;
All S is M :
No conclusion.

(7) **IA** is invalid. (Undistributed middle.)

No conclusion follows from this combination in the second figure, as the middle term is not distributed at least once. This may be proved also by diagrams.

(8) **OA** : Some P is not M ;
All S is M :
No conclusion.

(8) **OA** is invalid. (Illicit major.)

One of the premises being negative, the conclusion must be negative. The conclusion being negative, its predicate the major term P becomes distributed without being distributed in the premise. Thus, there is the fallacy of illicit process of the major term. The mood **OA**, therefore, is invalid in the second figure. This may be proved also by diagrams.

The Special Rules of the Second Figure

The *Special Rules* of the second figure are :— (1) The major premise must be universal. (2) *One* of the premises must be negative. (3) The conclusion must be negative.

proved by the general syllogistic rules.

Let us prove these special rules by the general syllogistic rules.

In the second figure the middle term is predicate in both the premises.

(1) If the major premise be not universal, it must be particular. The major term, therefore, is not distributed in the premise being the subject of a particular proposition. It must, therefore, be undistributed in the conclusion, as otherwise

there will be the fallacy of illicit major. The major term, which is the predicate of the conclusion, being undistributed in it, the conclusion must be affirmative, for only affirmative propositions do not distribute their predicates. The conclusion being affirmative, the premises must also be so. (Rule 7.) The middle term in that case would be undistributed in both the premises, being the predicates of affirmative propositions. Thus, on the supposition of the major premise being particular, there arises the fallacy of undistributed middle. So, the supposition is false, and the major premise in the second figure is universal, and not particular.

(2) As only negative propositions distribute their predicate, one of the premises in the second figure must be negative, to avoid the fallacy of undistributed middle. If both premises be affirmative, the middle term will not have the chance of being distributed at least once. Thus, one of the premises of the second figure must be negative.

(3) The third special rule follows directly from the general syllogistic rule that if one of the premises be negative, the conclusion must be so. This proof of the third rule evidently presupposes the truth of the second special rule, *viz.*, that one of the premises must be negative. This third rule, however, may be proved independently thus:—If the conclusion be not negative it must be affirmative. The conclusion being affirmative, both the premises must be so. (Rule 7.) In that case the middle term has not the chance of being distrib-

uted in either premise ; and consequently there arises the fallacy of undistributed middle. Thus, the supposition is false. The conclusion must, therefore, be negative.

Valid moods determined by the Special Rules.

We may, by applying these special rules to the sixteen possible moods, determine the valid moods of the second figure. By the first special rule the last eight moods, *viz.*, **IA**, **IE**, **II**, **IO**, **OA**, **OE**, **OI**, and **OO** are proved to be invalid, as in all of them the major premise is particular. By the second rule—that *one* premise must be negative—we reject the moods **AA**, **AI**, **EE**, and **EO**. Thus, only four are left, *viz.*, **AE**, **AO**, **EA**, and **EI** which stand the test of the special rules ; and these are technically called, as we have seen, **Camestres**, **Baroco**, **Cesare**, and **Festino**.

## § 13. Valid Moods and Special Rules of the Third Figure.

*Moods of the Third Figure:*

(1) **AA** is valid. (*Darapti.*)

(1) **AA** : All M is P ;
All M is S :
∴ Some S is P.

Both the premises being affirmative, the conclusion must be affirmative. The middle term is distributed in both the premises. The conclusion may, therefore, be either an **A** or an **I** proposition. But the conclusion cannot be **A**, as then there would be the fallacy of illicit process of the minor term. The conclusion should, therefore, be an **I** proposition, of the form 'Some S is P.' As no term is distributed in the conclusion, there is no possibility of illicit process. Thus, the mood

**AA** is valid in the third figure, leading to the conclusion **I**. It is technically called **Darapti**. It may be proved by diagrams as well.

(2) **AE** is invalid. (Illicit major.)

(2) **AE** : All M is P ;
No M is S :
No conclusion.

One of the premises being negative, the conclusion must be negative. The major term P, therefore, becomes distributed in the conclusion without being distributed in the premise. Thus arises the fallacy of illicit process of the major term, if any conclusion be drawn from the premises. The mood **AE** is, therefore, invalid in the third figure. It may be proved also by diagrams.

(3) **AI** is valid. (*Datisi*.)

(3) **AI** : All M is P ;
Some M is S :
∴ Some S is P.

The middle term is distributed in the major premise, being the subject of an universal proposition. Both the premises being affirmative the conclusion must also be affirmative, and one of the premises being particular, the conclusion must be particular. The conclusion should thus be of the form of 'I', or 'Some S is P.' As no term is distributed in the conclusion, there can be no illicit process. The mood **AI** is, therefore, valid in the third figure. It is technically known as **Datisi**. It may be proved also by diagrams.

(4) **AO** is invalid. (Illicit major.)

(4) **AO** : All M is P ;
Some M is not S :
No conclusion.

One of the premises being negative, the conclusion should be negative. The conclusion being negative, its predicate, the major term, becomes distributed ; but it is not distributed in the premises. Therefore, there arises the fallacy of illicit process of the major term, if any conclusion is drawn. The mood **AO** is, therefore, invalid in the third figure. It may be proved also by diagrams.

(5) EA is valid. (*Felapton.*)

(5) **EA** : No M is P ;
All M is S :
∴ Some S is not P.

The middle term is distributed in the premises. One of the premises being negative, the conclusion must be negative. The conclusion may, therefore, be either **E** or **O**. It cannot, however, be **E** ; for then there would be the fallacy of the illicit process of the minor term. The conclusion should, therefore, be an **O** proposition, of the form 'Some S is not P'. There is no illicit process, as the major term, which is distributed in the conclusion, is also distributed in the premise. The mood, therefore, is valid in the third figure ; and it is technically known as **Felapton.** It may be proved by diagrams as well.

(6) EI is valid. (*Ferison.*)

(6) **EI** : No M is P ;
Some M is S :
∴ Some S is not P.

The middle term is distributed in the major premise. One of the premises being negative, the conclusion must be negative ; and one of the premises being particular, the conclusion must be

particular. The conclusion must, therefore, be an **O** proposition of the form 'Some S is not P'. The major term P is distributed in the conclusion, and it was also distributed in the premise. There is, therefore, no illicit process. The mood, accordingly, is valid in the third figure and is technically known as **Ferison**. It may be proved also by diagrams.

(7) IA is valid. (*Disamis.*)

(7) **IA** : Some M is P ;
All M is S :
∴ Some S is P.

The middle term is distributed in the minor premise. Both the premises are affirmative ; therefore, the conclusion must be affirmative. (Rule 7.) One of the premises being particular, the conclusion must be particular. So the conclusion must be an **I** proposition—of the form 'Some S is P'. As no term is distributed in the conclusion, there is no possibility of illicit process. The mood is, therefore, valid in the third figure. It is technically called **Disamis**. It may likewise be proved by diagrams.

(8) OA is valid. (*Bocardo.*)

(8) **OA** : Some M is not P ;
All M is S :
∴ Some S is not P.

The middle term is distributed in the minor premise. The major premise being **O**, the conclusion must be **O**. The major term P is distributed in the conclusion, and it was distributed in the premise ; so there is no illicit process. The mood is, therefore, valid in the third figure.

It is technically called 'Bocardo'. It may be proved also by diagrams.

If we gather these results we find that the valid moods of the third figure are—**AAI, IAI, AII, EAO, OAO, EIO.**

The Special Rules of the Third Figure

The *Special Rules* of the third figure are :—

(1) The minor premise must be affirmative.

(2) At least one of the premises must be universal.

(3) The conclusion must be particular.

The second special rule is generally omitted, as it is one of the general rules. But, if the special rules are to be regarded as an independent mode of test, this rule should be recognised as one of the conditions of the validity of a mood of the third figure. Let us prove these special rules by the general syllogistic rules.

proved by the general syllogistic rules.

(1) If the minor premise be not affirmative, it must be negative. Then the major premise must be affirmative. (Rule 5.) One of the premises being negative, the conclusion must be negative. The predicate of the conclusion, that is, the major term thus becomes distributed in the conclusion without being distributed in the premise. The supposition is, therefore, false. Hence the minor premise must be affirmative, and not negative as supposed before.

(2) As the middle term is subject in both the premises in the third figure, it would not be distributed at least once, if both the premises be particular. To avoid the fallacy of undistrib-

uted middle, one of the premises must be universal.

(3) We have already proved that the minor premise must be affirmative. The minor term is not distributed in the premise, being the predicate of an affirmative proposition. The minor term, consequently, cannot be distributed in the conclusion. (Rule 4.) The subject of the conclusion, therefore, must be undistributed; in other words, the conclusion must be particular. We have proved this rule with the help of the first. We may, however, prove it independently thus:—If the conclusion be not particular it must be universal. Thus, the minor term would be distributed in the conclusion; and so it must be distributed in the premise (Rule 4), where it stands as predicate. The minor premise must, therefore, be negative (for only negative propositions distribute their predicate); and so the major must be affirmative (Rule 5) and the conclusion, negative (Rule 6). The major term, thus, becomes distributed in the conclusion without being distributed in the premise. Thus, on the supposition of the conclusion being universal, there arises the fallacy of illicit process of the major term. Hence the supposition is false: the conclusion must, therefore, be particular and not universal.

Valid moods determined by the Special Rules.

If now we apply these special rules to the sixteen possible moods, we find that according to the first special rule the moods **AE**, **AO**, **EE**, **EO**, **IE**, **IO**, **OE**, and **OO** are invalid, as the minor

premise in all of them is negative. By the second special rule the moods **II** and **IO** are cancelled, as both of them are particular. Thus, only six moods are found to be valid, which are technically called **Darapti, Disamis, Datisi, Felapton, Bocardo, and Ferison.**

## § 14. Valid Moods and Special Rules of the Fourth Figure.

*Moods of the Fourth Figure:*

(1) AA is valid. (*Bramantip.*)

(1) **AA** : All P is M ;
All M is S :
∴ Some S is P.

The middle term is distributed in the minor premise, being the subject of an universal proposition. Both the premises being affirmative the conclusion must be affirmative. It should, therefore, be an **A** or **I** proposition. It cannot be **A**, as the minor term is not distributed in the premise. The conclusion must, accordingly, be an **I** proposition of the form 'Some S is P.' The mood **AA** is, therefore, valid in the fourth figure, leading to the conclusion **I**. It is technically known as **Bramantip.** It may be proved also by diagrams.

(2) AE is valid. (*Camenes.*)

(2) **AE** : All P is M ;
No M is S :
∴ No S is P.

The middle term is distributed in the minor premise. One of the premises being negative, the conclusion must be negative. The conclusion may, therefore, be either an **E** or **O** proposition. If it be **E**, then both the major and minor terms would be distributed in it, and they are also

distributed in the premises. So there is no illicit process. The mood **A E** is, therefore, valid in the fourth figure, leading to the conclusion **E**. It is technically known as **Camenes**. It may be proved also by diagrams.

(3) **AI** is invalid. (Undistributed middle.)

(3) **A I**: All P is M;
Some M is S;
No conclusion.

The middle term in this combination is not distributed at least once. The mood, therefore, is invalid in the fourth figure, involving the fallacy of undistributed middle. It may be proved by diagrams as well.

(4) **AO** is invalid. (Undistributed middle.)

(4) **A O**: All P is M;
Some M is not S:
No conclusion.

The middle term is not distributed at least once in this combination. It is, therefore, invalid in the fourth figure, involving the fallacy of undistributed middle. It may likewise be proved by diagrams.

(5) **EA** is valid. (*Fesapo.*)

(5) **E A**: No P is M;
All M is S:
∴ Some S is not P.

The middle term is distributed in both the premises. One of the premises being negative, the conclusion must be so. The conclusion may therefore be an **E** or **O** proposition. It cannot be **E**, as the minor term is undistributed in the premise. It must, therefore, be **O**, of the form 'Some S is not P.' The major term is distributed in the conclusion; and it was also distributed in the

premise. Thus, there is no illicit process. The mood, therefore, is valid in the fourth figure; and it is technically known as **Fesapo**. It may also be proved by diagrams.

(6) EI is valid. (*Fresison.*)

(6) **E I**: No P is M;
Some M is S:
∴ Some S is not P.

The middle term is distributed in the major premise, being the predicate of a negative proposition. One of the premises being negative, the conclusion must be negative (Rule 6); and a premise being particular, the conclusion must be so (Rule 9). The conclusion, therefore, must be O. The major term is thus distributed in the conclusion; and it is also distributed in the premise, being the subject of an E proposition. Thus, there is no illicit process. The mood E A, accordingly, is valid in the fourth figure, leading to the conclusion O. It is technically known as **Fresison**. It may likewise be proved by diagrams.

(7) IA is valid. (*Dimaris.*)

(7) **I A**: Some P is M;
All M is S:
∴ Some S is P.

The middle term is distributed in the minor premise, being the subject of an universal proposition. Both the premises being affirmative, the conclusion must be so; and one of the premises being particular, the conclusion must also be so. So the conclusion must be an I proposition. As no term is distributed in the conclusion, there is no possi-

bility of illicit process. The mood, therefore, is valid in the fourth figure, leading to the conclusion I. It is technically known as **Dimaris**. It may be proved also by diagrams.

(8) OA is invalid. (Illicit major.)

(8) **OA** : Some P is not M ;
All M is S :
No conclusion.

One of the premises being negative the conclusion must be negative. Thus, its predicate, the major term, becomes distributed, while it was not distributed in the premise, being the subject of a particular proposition. There is, accordingly, the fallacy of illicit process of the major term ; and the mood is invalid. It may likewise be proved by diagrams.

The Special Rules of the Fourth Figure

The *Specials Rules* of the Fourth Figure are the following :—

(1) If the major premise be affirmative, the minor must be universal.

(2) If the minor premise be affirmative, the conclusion must be particular.

(3) If either premise be negative, the major premise must be universal.

(4) No premise can be particular and negative, *i.e.*, an O proposition.

(5) At least one of the premises must be affirmative.

(6) The conclusion can never be universal and affirmative.

proved by the general syllogistic rules.

These special rules may be proved by the general syllogistic rules thus :—

(1) If the major premise be affirmative, the middle term is undistributed in it. To avoid the fallacy of undistributed middle, it must be distributed in the minor premise—where it stands as subject. So, the subject of the minor premise must be distributed. In other words, the minor premise must be universal.

(2) When the minor premise is affirmative, the minor term is undistributed in it. So it must be undistributed in the conclusion. The subject of the conclusion, therefore, should be undistributed. In other words, the conclusion must be particular.

(3) If either premise be negative, the conclusion must be negative. The conclusion being negative, its predicate, the major term, is distributed. The major term, therefore, must be distributed in the premise. (Rule 4.) But, in the major premise, the major term is the subject in the fourth figure. So the subject of the major premise must be distributed. In other words, the major premise must be universal.

(4) No premise in the fourth figure can be an O proposition. The major premise cannot be O, for, in that case, the minor must be A, and the conclusion O, giving rise to the fallacy of illicit process of the major term. The minor premise cannot be O, as in that case the major must be A, giving rise to the the fallacy of undistributed middle. Thus, neither the major nor the minor premise in the fourth figure can be particular and negative.

(5) This rule, as we have read, is a general syllogistic rule (Rule 5). But, if we are to make the special rules an independent test of valid moods, then we should include this rule in the special rules of the fourth figure. Its proof will be the same as given under general syllogistic rules.

(6) If the conclusion be universal, the minor term will be distributed in it; and so it must be distributed in the premise. (Rule 4.) The minor premise must, therefore, be negative; and so the conclusion would also be negative. Thus, the conclusion can never be universal and affirmative.

Valid moods determined by the special rules.

Let us now apply the special rules to determine the valid moods of the fourth figure. Of the sixteen possible moods, **AI**, **AO**, **II**, and **IO** are found to be invalid by the first rule. By the third rule we reject **IE**, **OA**, **OE**, **OI**, and **OO**. The fourth rule excludes **EO**; and the fifth, **EE**. Thus, only **AA**, **AE**, **IA**, **EA**, and **EI** are left as valid moods, which are technically called **Bramantip**, **Camenes**, **Dimaris**, **Fesapo**, and **Fresison**.

§ **15. Aristotle's Dictum and Reduction.** Having explained the first three forms of syllogistic test, let us now turn our attention to the fourth form, namely, Aristotle's *Dictum* and Reduction. Aristotle, who is usually regarded as the father of syllogistic inference, tested its validlty by a *dictum* known as *Dictum de omni et nullo*. The

Meaning of the Dictum.

*Dictum* of Aristotle means—"Whatever is predicated of a term distributed, may in like manner be predicated of anything contained in the term."

The *Dictum* thus signifies, as Whately points out, that—

"1. Any thing whatever, predicated of a whole class, [major premise]

2. Under which also something else is contained, [minor premise]

3. May be predicated of that which is so contained". [Conclusion.]

The special rules of the First Figure and its valid moods directly follow from the *Dictum*.

When, therefore, we interpret the *Dictum* properly, we find it implying that (1) the major premise must be universal, and (2) the minor premise must be affirmative. The first part (*viz.*, 'whatever is predicated of a term distributed') indicates that the first or major premise must be universal, in as much as something is predicated in it of the subject in a distributed form. The last part of the *Dictum* (*viz.*, 'something contained in the term') implies that the second or minor premise must be affirmative. And these are the special rules of the first figure. We thus see that the *Dictum* is directly applicable to the first figure, determining its valid moods, which are **Barbara**, **Celarent**, **Darii**, and **Ferio**. (*Vide* § 11.)

The first figure is, accordingly, regarded as perfect; and the others figures, as imperfect.

As the *Dictum* of Aristotle directly applies to the first figure, this figure is regarded as the perfect figure. The second and third figures were regarded by Aristotle as imperfect, in as much as moods in these figures could not directly be tested by his *Dictum*. They were tested only by their reduction to the valid moods of the first figure. Hence the importance of reduction from the Aristotelian

Hence the importance of Reduction in

testing the moods of the imperfect figures.

standpoint. Without reduction the validity of the moods in the imperfect figures could not be determined. But now, when we have other means of testing the correctness of syllogistic reasoning, reduction is not absolutely necessary. It is a necessary appendix to the Aristotelian mode of testing the syllogistic argument. The fourth figure was not recognised by Aristotle. It has subsequently been added by Galen* ; and hence it is sometimes known as Galenian figure.

'Reduction' used in (1) a wide and (2) a narrow sense.

Two forms of Reduction: (I) Direct, and (II) Inpirect.

The term 'Reduction' may be used in (1) a wide sense to indicate the transformation of one mood into another, whether of the first or any other figure; but, (2) in a narrow sense, the term has been used to express the change of a mood of the second, third, or fourth figure into one of the first figure in order to submit it to the test of the *Dictum*. Reduction is of two forms (I) Direct and (II) Indirect. (I) *Direct or Ostensive Reduction* consists in at once changing an imperfect mood into a perfect mood by conversion, obversion, contraposition, or transposition of premises. (II) *Indirect Reduction* or *Reductio ad absurdum* consists in showing that the supposition of the contradictory of the given conclusion is false and so, by opposition, the given argument is correct. Let us explain the two forms of reduction one by one.

(I) *Direct Reduction.*

(I) **Direct Reduction.** Direct Reduction is intelligible by reference to the mnemonic verses

* Claudius Galenus was an eminent Greek Physician of the second century of the Christian era (131—200 A.D.)

indicating the valid moods of the different figures. The mnemonic lines run thus :

Mnemonic verses.

**Barbara, Celarent, Darii, Ferioque, prioris ;**
**Casare, Camestres, Festino, Baroco, secundae ;**
**Tertia, Darapti, Disamis, Datisi, Felapton,**
**Bocardo, Ferison, habet ; quarta insuper addit**
**Bramantip, Camenes, Dimaris, Easapo, Fresison.***

Every valid mood is here represented by a separate word ; and many of the letters used in the composition of such a word are significant. The initial letter of an imperfect mood indicates, for example, that it is to be reduced to a mood of the first figure beginning with the same letter. Thus, *Camestres* or *Camenes* is to be reduced to *Celarent*, and *Darapti* or *Dimaris* to *Darii*. B, C, D, F, as the first four consonants, were chosen for the moods of the first figure, to which the other moods are to be reduced. The letter **m** (from **m**etathesis præmissarum) implies that the premises of the imperfect mood in which it occurs are to be transposed. The letter **s** (from conversio Simplex) signifies that the proposition represented by the vowel before it, is to be simply converted ; and **p** (from conversio **p**er accidens),

Meanings of the letters in the mnemonic words.

* Professor Baynes in his Translation of *Port Royal-Logic* observes in a note, "These mnemonic verses are very ingenious, and of considerable though uncertain antiquity in the science. They are found, for the first time, in a manual of Peter Hispanus, who flourished in the thirteenth century. There is no direct evidence, however, that he was the author of them, though this is probable, as the treatise of Aquinas, in which they are quoted, is in all likelihood spurious." (P. 412.)

that it is to be converted per accidens or by limitation. When **s** or **p** occurs after the third vowel, the meaning is to be applied to the conclusion of the new syllogism of the perfect figure, and not to the original conclusion of the imperfect mood in which it is found. The letter **c** (from **c**onversio syllogismi, or ductio per **c**ontradictoriam propositionem sive per impossibile) means that the older logicians, who objected to the use of negative terms, reduced the moods, in which it is found, indirectly, *i.e.*, by *Deductio ad absurdum or impossibile* ; and the position of the letter shows that the premise indicated by the vowel before it is to be replaced by the contradictory of the conclusion to form a mood in Barbara. Thus, **Baroco** and **Bocardo** alone were reduced by the indirect method. The other letters (*viz.*, l, r, n, t) are without any logical significance ; they have been introduced only to help pronunciation. De Morgan calls the mnemonic words "The magic words by which the different moods have been denoted for many centuries, words which I take to be more full of meaning than any that ever were made". Let us illustrate these remarks by examples.

*Illustrations :*

(1) *Camestres* reduced to *Celarent* ;

| (1) *Camestres* (Fig. II.) | reduced to *Celarent.* |
|---|---|
| All P is M, | No M is S (converse of the original minor), |
| No S is M, | All P is M (original major), |

| | |
|---|---|
| ∴ No S is P. | ∴ No P is S : |
| | ∴ No S is P (converse of the new conclusion). |

(2) *Disamis*, to *Darii* ;

| (2) *Disamis* (Fig. III.) reduced to | *Darii.* |
|---|---|
| Some men are wise, | All men are mortal, |
| All men are mortal, | Some wise beings are men, |
| ∴ Some mortal beings are wise. | ∴ Some wise beings are mortal ; |
| | ∴ Some mortal beings are wise. |

(3) *Bramantip*, to *Barbara* ;

| (3) *Bramantip* (Fig. IV.) reduced to | *Barbara.* |
|---|---|
| All P is M, | All M is S, |
| All M is S, | All P is M, |
| ∴ Some S is P. | ∴ All P is S ; |
| | ∴ Some S is P. |

(4) *Fesapo*, to *Ferio*.

(4) *Fesapo* (Fig. IV.) reduced to *Ferio.*

No monkeys are men,...No men are monkeys (converse),

All men are animals,...Some animals are men (converse),

| | |
|---|---|
| ∴ Some animals are not monkeys. | ∴ Some animals are not monkeys. |

(II) *Indirect Reduction.*

(II). **Indirect Reduction.** By this form of reduction we try to prove an imperfect mood as valid by showing that the contradictory of its conclusion can never be supposed as true. It may be illustrated thus :—

*Illustrations :*

(1) *Baroco* reduced to *Barbara.*

(1) *Baroco* (Fig. II).

All crows are birds ;
Some animals are not birds :
∴ Some animals are not crows.

As the premises in deductive reasoning must always be accepted as true, we may dispute the truth of the conclusion alone. If it be false, its contradictory 'All animals are crows' must be true. (*Vide* Chap. X, § 6.) Combining this as a minor premise with the original major, we get the following syllogism in *Barbara* :

All crows are birds ;
All animals are crows ;
∴ All animals are birds.

The new conclusion, however, is the contradictory of the original minor premise. So both of them cannot be true; and we have no right to dispute the truth of the original premise. Thus, the new conclusion must be false. The falsity may be due to either the process of reasoning or the falsity of the premises. But there can be no error in the process, as the argument is in the perfect mood *Barbara,* and so sanctioned by the *Dictum.* The error must, therefore, be due to the premises. But the major premise cannot be false, as it is the original major and so assumed as true. Hence

the new premise is false ; and its contradictory, the original conclusion, is true, and not false, as supposed before. *Baroco* is thus proved to be valid with the help of the perfect mood *Barbara*.

(2) *Bocardo* reduced to *Barbara*.

(2) *Bocardo* (Figure III.)

Some M is not P ;
All M is S :
∴ Some S is not P.

As we have no right to dispute the truth of the premises of a syllogism, they must be assumed as true. If the conclusion 'Some S is not P' be not true, then its contradictory 'All S is P' must be true. Form a syllogism with 'All S is P' as the major and the original minor premise as the minor, so as to form a mood in *Barbara* :

All S is P ;
All M is S :
∴ All M is P.

The conclusion of the new syllogism in *Barbara* is the contradictory of the original major premise. Both of them, therefore, cannot be true (according to the rules of Opposition.) But, as the original major premise, 'Some M is not P' is given to be true, we must conclude that the new conclusion, 'All M is P', is false. The falsity may be due to either of two causes : (1) error in the process of reasoning, or (2) error in the premises. But the first supposition is false : the mood being in *Barbara*, there can never be an error in the process. Thus, the second alternative alone is acceptable. Of the two premises 'All S is P',

and 'All M is S', the second premise (namely, 'All M is S') must be accepted as true, as it is the original minor premise. The new major premise, 'All S is P', is therefore false. Hence its contradictory, the original conclusion, 'Some S is not P', is true, and not false as supposed before. Thus, *Bocardo* is proved to be a valid mood of the third figure by its reduction to the perfect mood *Barbara*.

*Baroco* and *Bocardo*, though indirectly reduced by older logicians, are reducible directly.

We have already mentioned that the older logicians, owing to their aversion to use negative terms, were forced to reduce *Baroco* and *Bocardo* indirectly. But we can now reduce them directly with the help of obversion and contraposition (involving the use of negative terms). In direct reduction, *Baroco* should be denominated **Faksoko**; and *Bocardo*, **Doksamosk**, '**K**' implying obversion of the proposition before it. Let us illustrate these remarks by examples.

In direct reduction, *Baroco* is represented as *Faksoko*; and *Bocardo*, as *Doksamosk*.

(1) *Faksoko* reduced to *Ferio*.

| (1) *Faksoko* | reduced to *Ferio*. |
|---|---|
| All P is M,......... | ...........No not-M is P ; |
| Some S is not M,............ | ......Some S is not-M : |
| Some S is not P. | ∴ Some S is not P. |

Owing to '**KS**' in *Faksoko*, the premise **A** is first obverted (as required by '**K**') and then the obverse is simply converted (as required by '**S**'); and the minor premise '**O**' is only obverted, as required by '**K**.'

(2) *Doksamosk* reduced to *Darii*.

| (2) *Doksamosk* | reduced to *Darii*. |
|---|---|
| Some M is not P ; | All M is S ; |
| All M is S ; | Some not-P is M : |
| ∴ Some S is not P. | ∴ Some not-P is S. |

∴ Some S is not-P (converse of the new conclusion.)
∴ Some S is not P (obverse of the converse).

Here also the premise '**O**' is obverted and the obverse converted, as required by '**KS**'; the premises are transposed as required by '**M**'; and the new conclusion in *Darii* is converted, and the converse obverted, as required by '**SK**' after the third vowel.

It may be mentioned in this connection that though only *Baroco* and *Bocardo* were reduced indirectly by the older logicians, yet the other moods also may be reduced indirectly. In fact, we can now reduce any one mood to another, either directly or indirectly. And Reduction, though not now absolutely necessary to prove the validity of certain arguments, is still a good intellectual discipline, bringing out the fundamental unity of the different forms of syllogistic inference. Let us illustrate our remarks by reference to a few examples.

We can now reduce any one mood to another of any figure, either directly or indirectly, thus proving the essential unity of the syllogistic process.

*Illustrations*:

(1) Indirect reduction of *Ferison*.

(1) Indirect Reduction of *Ferison* (Figure III).

No M is P;
Some M is S:
∴ Some S is not P.

As the premises are given to be true, the conclusion alone may be supposed as false. Therefore, its contradictory 'All S is P' must be true. Combining this as the major with the original

minor as the minor premise we get the following syllogism in *Darii*.

All S is P;
Some M is S:
∴ Some M is P.

This conclusion and the original major being contradictories cannot both be true. As the premise, however, is assumed to be true, the new conclusion must be false. And, as the falsity is not due to the process, which is in the perfect mood *Darii*, the premises of the new syllogism may be false. The minor premise however, being the original minor, is given as true. Therefore, the major premise, 'All S is P,' is false; and its contradictory, the original conclusion (*viz.*, 'Some S is not P') is true, and not false, as supposed before.

(2) Indirect reduction of *Bramantip*.

(2) Indirect Reduction of *Bramantip* (Fig. IV.)

All poets are imaginative;
All imaginative men are sentimental:
∴ Some sentimental persons are pœts.

If the conclusion be not true, its contradictory 'No sentimental persons are poets' must be true. Combining this as the major with the original minor as the minor, we get the following syllogism in *Celarent*:

No sentimental persons are poets;
All imaginative men are sentimental:
∴ No imaginative men are poets:
∴ No poets are imaginative. (Converse.)

The converse of the new conclusion is the contrary of the original major, which is assumed as true.

Thus the converse, and so the new conclusion, is false. The falsity, not being due to the process (which is in the perfect mood *Celarent*) nor to the minor premise (which, as a premise of the original syllogism, is assumed to be true) is evidently due to the. new major premise. Hence its contradictory, the original conclusion, is true, and not false, as supposed before.

Reduction of one mood into another of the same figure.

Let us conclude this section by illustrating the reduction of one mood into another of the same figure.

*Illustrations :*

(1) *Celarent* reduced to *Barbara.*

(1) *Calarent* (Fig. I.) reduced to *Barbara.*

| | |
|---|---|
| No M is P ; | All M is not-P (obverse of the major) ; |
| All S is M : | All S is M : |
| ∴ No S is P. | ∴ All S is not-P ; |
| | ∴ No S is P. (Obverse.) |

(2) *Darapti* reduced to *Felapton.*

(2) *Darapti* (Fig. III.) reduced to *Felapton.*

| | |
|---|---|
| All M is P ; | No M is not-P (obverse of the major ) ; |
| All M is S : | All M is S : |
| ∴ Some S is P. | ∴ Some S is not not-P : |
| | ∴ Some S is P. (Obverse.) |

A fundamental syllogism is one the premises of which just satisfy the conditions of the conclusion warranted by them.

16. **Fundamental, Strengthened, and Weakened Syllogisms**. A syllogism is said to be fundamental when the requirements of the conclusion are just satisfied by the premises, no term being unnecessarily distributed in them which is not distributed in the conclusion. Thus, as De Morgan observes, a **fundamental syllogism** is one of which neither prem-

There are altogether fifteen fundamental moods.

ise is stronger than what is required to prove that conclusion. Of the nineteen valid moods, we find no less than fifteen to be fundamental. **A strengthened syllogism**, on the other hand, is one of which one of the premises is unnecessarily stronger than what is necessary to justify the conclusion. Thus in a strengthened syllogism a term is distributed in the premises in excess of what is required to establish the conclusion. For example, in the mood *Darapti* of the third figure, the same conclusion will follow if one of the premises be taken as an I instead of as an A proposition. **A weakened syllogism**, again, is one in which a particular conclusion is drawn when a universal is justified by the premises. In the mood *Celarent*, for example, the conclusion O may be drawn instead of E; and in that case the mood EAO would be regarded as a weakened syllogism of the first figure. Such a syllogism is also called a **subaltern mood**, as the conclusion in such a mood follows by subalternation from the corresponding universal conclusion justified by the premises. The subaltern moods are AAI and EAO in the first, EAO and AEO in the second, and AEO in the fourth figure. It is evident that there can be no subaltern mood in the third figure, as the conclusion in this figure is always particular. If we take into account the subaltern moods in the different figures, we find that there are altogether six strengthened syllogisms, two in each figure, *viz.*, AAI and EAO in the

A strengthened syllogism is one which has an unnecessarily stronger premise.

A weakened syllogism is one of which the conclusion is weaker than what is justified by its premises.

A weakened syllogism is called a subaltern mood.

The third figure can have no subaltern mood.

There are altogether six strengthened

first, EAO and EAO in the second, AAI and EAO in the third, and AAI and EAO in the fourth figure. Thus, all moods, except AEO in the fourth figure, which have two universal premises leading to a particular conclusion, may be regarded as strengthened syllogisms. We may also remember in this connection that the valid moods which are common to all the figures are only two, *viz.*, EAO and EIO.

syllogisms, two in each figure.

EAO and EIO are valid in all the figures.

**§ 17. Characteristics and Uses of the Different Figures.** The characteristics of the four figures and their special uses may be indicated thus :—

*The First Figure.* It is the natural figure.

**Figure I.** (1) The ordinary and natural interpretation of a proposition is to take its subject in denotation and its predicate in connotation. (*Vide* Chap. VI, § 5.) When a term, therefore, is used as a subject or as a predicate in the premises, the natural order will be to use it in the same way in the conclusion. Otherwise we proceed from the denotative or connotative use of a term to its connotative or denotative use. And this involves an inversion of the original order of thought. It should be noted that there is no such inversion in the first figure, as the term which is used as the subject of the minor premise is the subject of the conclusion, and the term which is the predicate of the major is the predicate of the conclusion. This figure, therefore, is the natural form of syllogistic reasoning ; and Aristotle is not wrong in regarding it as the perfect figure.

(2) It proves all propositions.

(2) This is the only figure in which all the possible forms of propositions—A, E, I, and O—are proved. It accordingly serves all uses.

(3) It alone proves an A proposition.

(3) This is the only figure which proves an 'A' proposition. And the importance of establishing an 'A' proposition can never be under-estimated. All general statements about the qualities and relations of things and classes are 'A' propositions. Hence Lambert indicates the special use of the figure as proving the properties and qualities of objects. This figure is generally employed in the deductive sciences, as they are mostly concerned with establishing 'A' propositions. (*Vide* Chapter. I, § 8.) This figure, as Aristotle points out, is best adapted to demonstration, as supplying conclusions universally affirmative. Hence this figure is commonly used by mathematicians. (*Vide* Chapter. I, § 12.)

and is thus suited to prove the qualities of things.

It is best adapted to demonstration.

*The Second Figure.*

(1) There is a partial inversion in the use of the extremes in the conclusion.

Figure II. (1) In this figure there is a partial change in the use of the extremes : the major term for example, is used as subject of the major premises, while it becomes the predicate of the conclusion. We thus pass from its denotative to its connotative use.

(2) It proves only negative propositions and is thus suited to prove distinctions.

(2) This figure proves only negative propositions. Lambert, accordingly, mentions that this figure is fitted for proving the distinctions between things. All distinctions, we should remember, are expressed in negative propositions. For example, 'Fishes are not warm-blooded'; but 'Whales are warm-blooded'; therefore 'Whales are not fishes.'

Or, 'Metals have metallic lustre'; but 'This substance has no lustre'; therefore, 'It is not a metal.'

*The Third Figure.* (1) There is a partial inversion in the use of the extremes.

**Figure III.** (1) In the third figure there is also a partial change in the use of the extremes. The minor term, which is used as predicate of the minor premise, becomes the subject of the conclusion. Thus, we proceed from its connotative to its denotative use.

(2) It proves only particular propositions and is so suited to prove instances or exceptions.

(2) In this figure we can prove only particular propositions. Lambert, accordingly, mentions that it is the figure suited to prove instances or exceptions. To disprove, for example, that 'All metals are solids', we may advance the following argument in the third figure:—'Mercury is not solid', and 'Mercury is a metal'; therefore, 'Some metal is not solid.'

(3) When the middle term is singular, an argument naturally assumes this form.

(3) Whenever the middle term is singular, our argument naturally assumes the form of this figure; *e.g.*, 'Mount Everest is the highest mountain in the world,' 'Mount Everest is always snow-capped,' therefore 'The highest mountain in the world is always snow-capped.'

*The Fourth Figure.* (1) In it there is complete inversion in the use of the extremes.

**Figure IV.** (1) In the fourth figure there is complete inversion in the use of the extremes. The minor term is used as predicate in the premise, while as subject in the conclusion; and thus we proceed from its connotative to its denotative use. The major term, again, is used as subject in the premise and as predicate in the conclusion. Thus, we proceed from its denotative to its connotative

It does not represent the natural mode of argument.

use. This figure does not, therefore, represent quite a natural mode of argument. Hence, it was ignored by Aristotle; and its use has been condemned even by modern logicians. Bowen, for example, remarks, "The mind revolts at this perversion, striving to preserve the same order in the conclusion which it observed in the premises.........Hence it appears, that what is called the Fourth Figure is only the First with a converted conclusion ; that is, we do not actually reason in the Fourth, but only in the First, and then, if occasion requires, convert the conclusion of the First." (*Logic*, p. 192.)

(2) It is suited to the discovery or exclusion of the different species of a genus :

(2) Lambert observes that this figure is suited to "The discovery or exclusion of the different species of a genus." For example, 'Some birds are crows,' and 'All crows are sagacious,' therefore 'Some sagacious animals are birds'; Or, 'No triangles are squares,' and 'All squares are equiangular,' therefore 'Some equiangular figures are not trianlges.' It may be mentioned, however, that such relations are often more satisfactorily proved by the first than by the fourth figure.

but even such relations are better proved in the first figure.

§ 18. **Pure Hypothetical Syllogisms.** Having explained the characteristics, forms, and conditions of syllogistic reasoning by reference to Pure Categorical Syllogisms, let us illustrate them in reference to Pure Hypothetical Syllogisms which are quite analogous in their composition and result. The same rules and methods apply to both the cases. We should remember, however, that hypothetical propositions are always

affirmative, expressing a relation of dependence between the antecedent and the consequent, which correspond to the subject and the predicate of a categorical proposition. The quantity of a hypothetical proposition is determined, as mentioned before, by the quantity of the antecedent. *Darii*, for example, would be represented in the hypothetical form thus :

In all cases if M is, P is ;
In some cases if S is, M is :
∴ In some cases if S is, P is.

The validity of this mood may be proved by the general syllogistic rules. The middle term is distributed in the major premise and the conclusion is justified by rules 7 and 9. As no term is distributed in the conclusion, which is an I proposition, there can be no illicit process. The argument may similarly be tested by diagrams, special rules, and Aristotle's *Dictum*.

We have seen that hypothetical propositions can be reduced to the categorical form. (*Vide* Chap X, § 8); and so pure hypothetical syllogisms can be redcued to pure categorical sylogisms. The above example may be reduced to the categorical form thus :

All cases of the exisistence of M are cases of the existence of P ;

Some cases of the existence of S are cases of the existence of M :

∴ Some cases of the existence of S are cases of the existence of P.

§ **19. Hints for Solving Problems.** (1) In proving rules we should always try to establish them generally, instead of by reference to particular cases; and direct proof is to be preferred to the indirect.

(2) Proof by rules is to be preferred to proof by diagrams. The one appeals more to understanding, while the other, to ocular experience. We should remember that, in proof by diagrams, if any combination be left out, the proof would be seriously defective. The essence of such proof lies in showing that some *common* conclusion follows or does not follow from *all* the cases.

(3) In testing arguments, we should first carefully reduce the constituent propositions to their logical form and thus determine their quantity and quality.

(4) In determining the mood and figure of an argument we should carefully ascertain the minor and major terms and so the minor and major premises.

(5) In testing by general rules, we should apply with special care rules 3 and 4.

## Illustrations.

1. *Prove that when the conclusion is universal the middle term can be distributed but once.*

When the conclusion is universal, it is either A or E. (1) When it is A, both the premises must be A (Rules 7 and 9); and so only two terms are distributed in the premises, one of which is distributed in the conclusion. (2) When the conclusion is E, one of the premises must be E and the other A (Rules 6 and 9); and so only three terms are distributed in the premises, of which two are taken up in the conclusion. Thus, in this case, too,

only one term is left distributed for the middle term. Hence we see that the middle term can be distributed only once when the conclusion is universal.

2. *Show that an A proposition can be proved only in the first figure.* When the conclusion is A, both the premises must be A (Rules 7 and 9), whose subjects alone are distributed. As the minor term is distributed in the conclusion, it must be distributed in the premise, and so it must be the subject of the minor premise. The middle term therefore, is the predicate of the minor premise and is undistributed in it. The middle term, accordingly, must be distributed in the major premise (Rule 4), and so it must be its subject. Thus, when the conclusion is A, the middle term is subject in the major and predicate in the minor premise. In other words, the argument then is in the first figure.

3. *Show that O cannot stand as a premise in figures I and IV.* This rule has already been proved in the case of the fourth figure in § 14. Let us, then, prove it only in the first figure. If the major premise in it be O, then the minor must be A, and so the middle term will not be distributed at least once. If the minor premise be O, the major must be A and the conclusion O, giving rise to the fallacy of illicit major. Hence no premise can be O in the first or the fourth figure.

4. Test the following arguments :—

(*a*) My hand touches the table ;
The table touches the floor :
∴ My hand touches the floor.

(*b*) John must be honest, for he is straightforward and only straightforward men are honest.

(*c*) James is eligible for the post, as he is a graduate, and graduates alone are so eligible.

(*d*) All men are not industrious; but Brown is industrious. So he cannot be a man.

(*e*) He who calls you a man speaks truly;
He who calls you a fool calls you a man:
∴ He who calls you a fool speaks truly.

(*a*) When reduced to logical form, the argument stands thus:

The table is that which touches the floor;
My hand is that which touches the table:
∴ My hand is that which touches the floor.

Here there is no middle term: 'the table' and 'that which touches the table,' are not the same either in form or in meaning. Thus, there is the fallacy of four terms.

(*b*) The argument may be put in logical form thus:
All who are honest are straightforward;
John is straightforward; (*Vide* Chap. VII, § 8.)
∴ John is honest.

The middle term 'straightforward' is undistributed in both the premises, as they are affirmative. There is thus the fallacy of undistributed middle.

(*c*) The argument in logical form stands thus:
All who are eligible for the post are graduates; (*Vide* Chap. VII, § 8.)
James is a graduate:
∴ James is eligible for the post.

The same fallacy as in (*b*).

(*d*) The logical form is—
Some men are not industrious;
Brown is industrious;
∴ Brown is not a man.

Here the major term 'man' is distributed in the conclusion, being the predicate of a negative proposition, while it is undistributed in the premise, being the subject of a particular proposition. There is thus the fallacy of illicit process of the major term.

(*c*) Here the middle term 'calls you a man' is used ambiguously: in the first premise it means actually summons you by the name 'man', while in the second it means implies or supposes that you are a man. The argument, accordingly, involves the fallacy of ambiguous middle or four terms. (Rule 1.)

## § 19. Exercises.

1. Define a Syllogism and state its characteristics. How do you determine the validity of syllogistic argument?

2. Distinguish between the Greek and the Hindu Syllogism. What do you understand by the major, middle, and minor terms? Why are they so called?

3. Define Mood. How many possible moods are there, and which of them are valid? What are subaltern moods, and why are they so called?

4. Explain and illustrate the method of testing syllogisms by diagrams.

5. Prove the following rules :—

(1) The middle term must be distributed at least once.

(2) No term should be distributed in the conclusion which was not distributed in the premise.

(3) If both the premises be particular or negative no conclusion follows.

(4) If either premise be negative or particular the conclusion must also be the same.

6. Frame concrete examples in *Disamis*, *Bokardo*, and *Camenes*, and reduce them both directly and indirectly.

7. Frame concrete examples in **AA**, **EA**, **AE**, and **OA** in the different figures and test their validity.

8. State and prove the special rules of the different figures.

9. Prove the following by the general syllogistic rules :—

(1) The major premise must be universal in the first and second figures.

(2) The minor premise must be affirmative in the first and third figures.

(3) No premise can be an **O** proposition in the first or in the fourth figure.

(4) An **A** proposition can be proved only in the first figure.

(5) In the first figure the conclusion must have the quality of the major and the quantity of the minor premise.

(6) If the conclusion be universal, the middle term can be distributed but once.

(7) In the second figure, the conclusion must be negative and have the quantity of the minor premise; and in the third figure, the conclusion must be particular and have the quality of the major premise.

10. Explain Aristotle's *Dictum* and show that it directly applies to the first figure.

11. What is Reduction? Is it necessary? Reduce *Camestres*, *Darapti*, *Bramantip*, and *Dimaris* both directly and indirectly. Reduce *Ferison* to *Datisi* and *Fresison* to *Barbara*.

12. What are strengthened and weakened syllogisms? Are they connected in any way?

13. What do you mean by a Figure? How many Figures are there? Indicate the peculiarities and uses of the different Figures.

14. Examine the combinations **AEE** and **OIE** and show whether they are valid under any of the syllogistic figures, giving your reasons.

15. What are Hypothetical Syllogisms? How do you test them? Give a concrete example and reduce it to the categorical form.

16. In which of the following syllogisms is the conclusion valid under any mood and figure, and in which it is invalid, and why :—**EAE, EAA, EIO, IEI** ?

17. Name the figure or figures in which **E** and **O** can be proved.

18. Under what figures are **EA, IA** and **AO** valid. and why are they valid under these and no others ?

19. In what moods and figures are the following arguments ? Reduce them to the first figure.

(*a*) All balls are not red ; all balls are round : therefore, some round things are not red.

(*b*) All men are created beings ; men generally are prudent : therefore, all created beings are prudent.

(*c*) None but the industrious are prosperous ; only the healthy are industrious ; therefore, all healthy men are prosperous.

20. Put the following arguments in logical form and examine their correctness :—

(1) You are not what I am ; but I am a man : therefore, you cannot be a man.

(2) James cannot be rich, for he is not fashionable, and only the rich are fashionable.

(3) Jadu is wise, for he is careful, as wise men are.

(4) He who says that you are a sentient being speaks truly ; but he who says that you are a monkey says that you are a sentient being : therefore, he who says that you are a monkey speaks truly.

(5) None but the honest are honoured ; but James is not honoured : therefore he is not honest.

(6) Many things are more difficult than to do nothing ; but nothing is more difficult than to walk on one's head : therefore, many things are more difficult than to walk on one's head.

(7) Every book is not useful; and all books are not interesting: therefore, some useful things are not interesting.

(8) The honest alone are trustworthy; and James being honest, he may be trusted.

(9) Birds have wings; bats are not birds: therefore, bats have no wings.

(10) Tyrants are always suspicious, but are not always wise; wise men, therefore, are not always suspicious.

(11) If he says that he did not tell a lie, why, I ask, did he look abashed, as liars always do?

(12) James is truly noble, for he is virtuous, and only the virtuous are truly noble.

(13) Satire is a legitimate mode of exposing the failings of others; but the calling of others by ill-names is not satire: therefore, it is no legitimate mode of exposing their failings.

(14) None but the good are really to be envied; all truly wise men are to be envied.

(15) Branches of education are good which inform the mind with moral ideals. Mathematics is a branch of education which does not inform the mind with moral ideals. Therefore, Mathematics is not good.

(16) Education removes or prevents errors. The use of a good Dictionary removes or prevents errors. Therefore, the use of a good Dictionary is education.

(17) Bees are useful little insects; they gather honey: therefore, the little insects that gather honey are useful creatures.

(18) The Moon goes round the Earth; the Earth, round the Sun: and therefore, the Moon, round the Sun.

(19) Every hen comes out of an egg; every egg comes out of a hen: therefore, every egg comes out of an egg.

(20) He must have the plague, for he has fever, and fever is one of the symptoms of plague.

(21) I, an egoist! I know I am not one; envy is an egoist: and on whatever ways I have strayed, you have never found me on the path of envy.

(22) All stars twinkle; but planets do not twinkle: therefore, planets are not stars.

(23) No kind of spirituous liquor ought to be drunk in excess: but water is not a spirituous liquor: therefore water ought to be drunk in excess.

(24) All nations which are self-governed are prosperous: India is not self-governed: therefore, it is not prosperous.

(25) Skilful labour is highly paid; the work of the metaphysician is skilful labour: therefore, it is highly paid.

(26) Everything is allowed by law which is morally right; indulgence in pleasures is allowed by law: therefore, indulgence in pleasures is morally right.

(27) Every country which possesses abundance of gold money is prosperous; India does not possess much gold money: it cannot, therefore, be a prosperous country.

(28) No tale-bearer is to be trusted, and, therefore, no great talker is to be trusted, for all tale-bearers are great talkers.

(29) It is impossible that thought can be a function of matter, because all functions of matter are modes of motion, which thought is not.

(30) Half a loaf is better than no bread; no bread is better than no friends: therefore, half a loaf is better than no friends.

(31) Most plants decompose carbonic acid; but fungi do not: fungi, therefore, are not plants.

(32) Some bacteria must be animals, because they require organic food, as all animals do.

(33) This syllogism must be valid; for, like valid syllogisms, it has three terms.

(34) None but the good are really to be envied; all truly wise men are good: therefore, all truly wise men are to be envied.

(35) Since the laws allow all that is innocent, and avarice is allowed, it must be innocent.

(36) Dr. Johnson remarked that "a man who sold a a penknife was not necessarily an ironmonger." Against what logical fallacy was this remark directed ?

(37) Animals cannot live without atmosphere ; there is no atmosphere on the moon : therefore, there can be no animal life on the moon.

(38) None but material bodies gravitate ; air gravitates : therefore, it must be material.

(39) Solon was really competent to rule, for we know he was wise ; and it is the wise only who are fitted to rule.

(40) The conclusion of this syllogism cannot be particular, as both of its premises are universal, and syllogisms with a particular premise give a particular conclusion.

21. What is the least, as well as the greatest, number of terms that can be distributed in the premises of a syllogism ?

22. What should be the quantity of the conclusion when the middle term is twice distributed ? In what mood and figure is such an argument possible ?

23. Do two particular premises ever justify any conclusion ? If so, when ?

24. What do you know about the minor premise when the middle term is the subject in the major ?

25. Show that a negative minor premise necessitates a universal major and a particular major premise precludes a negative minor.

## CHAPTER XII.

### MIXED SYLLOGISMS.

§ **1. Classification of Mixed Syllogisms.** We have seen (*Vide* Chap. XI, § 4) that syllogisms may be classified into Pure and Mixed according as the constituent propositions are of the same or of different relations. Having considered Pure Syllogisms——Categorical and Hypothetical——in the last chapter, let us now turn our attention to the examination of the Mixed Forms. Mixed Syllogisms may be divided into three classes, *viz.*, (1) Hypothetical-categorical, (2) Disjunctive-categorical, and (3) the Dilemmas. (1) In the first form, the major premise is hypothetical, the minor, categorical, and the conclusion is also categorical. (2) In the second form, the major premise is disjunctive, the minor categorical, and the conclusion, also categorical. (3) In the third form, we have combinations of hypothetical and disjunctive propositions justifying a conclusion. Let us consider these forms one by one.

Syllogisms are either Pure or Mixed.

Mixed Syllogisms are either (1) Hypothetical-categorical, or (2) Disjunctive-categorical, or (3) Dilemmatic.

§ **2.** (1) **Hypothetical-categorical Syllogisms.** A Syllogism of this type is composed, as mentioned above, of a hypothetical proposition as major, a categorical as minor, and a categorical as conclusion. Such Syllogisms have often been called simply hypothetical; but they should better be

(1) Hypothetical-categorical syllogisms have a hypothetical major, a categorical minor, and a categorical

conclusion.

designated hypothetical-categorical, to contradistinguish them from pure hypothetical syllogisms considered in § 18 of the last Chapter. To determine the true character and conditions of such a syllogism, we should remember that hypothetical propositions are always affirmative, expressing a relation of dependence between the antecedent and the consequent. (*Vide* Chap. VII, § 4.) In fact, in the absence of such a relation, we are not justified in inferring anything with regard to one, when we know something about the other. "One thing," says Kanad, "can never be an argument for the existence of another thing with which it is wholly unconnected": अर्थान्तरं ह्यर्थान्तरस्याऽनपदेशः (*Vaiseshika Aphorisms*, III, i, 8. Gough's Edition, p. 81.) Thus, the following rules of this form of mixed syllogism rest on the assumption of a relation of dependence between the antecedent and the consequent. The rules are:

Hypothetical propositions are always affirmative, implying a relation of dependence between the antecedent and the consequent.

Rules of inference.

(1) If we affirm the antecedent we may affirm the consequent, but not conversely, that is, we are not justified in affirming the antecedent on affirming the consequent.

(2) If we deny the consequent, we may deny the antecedent, but not conversely, that is, we are not entitled to deny the consequent on the denial of the antecedent.

Reason of the rules:

The reason of these two rules is to be found in the fact that the antecedent stands for the ground and the consequent for what necessarily follows from it. We may thus infer an effect from

a cause or the absence of a cause from the absence of its effect. We may, for example, infer the presence of light from the presence of the sun, or the absence of the sun from the absence of light. We may, likewise, draw inferences in the case of dependence of one thought upon another. Thus, we may infer the presence of fire from the presence of smoke, or the presence of men from the presence of foot-prints. Thus, either logical or dynamical dependence is the ground of inference in this form of reasoning. In fact, if there be no such dependence, the two members of a hypothetical proposition can never be connected as antecedent and consequent. With regard to the hypothetical major of this form of mixed inference Hamilton observes, "It is true that the antecedent or the consequent of such assumption may be negative as well as affirmative; for example, *If Caius be not virtuous, he is not entitled to respect, If the sun be not risen, it is not day.* But here the proposition, as an hypothetical judgment, is and must be affirmative. For the affirmation in such a judgment is contained in the positive assertion of the dependence of consequent on antecedent; and if such a dependence be not affirmed, an hypothetical judgment cannot exist" (*Lectures*, III, p. 349.)

Logical or dynamical dependence is the ground of inference.

Hamilton's testimony.

The converse of the two rules is not true, because the effect or consequent may be due to more than one cause or antecedent. Thus, from the absence of a particular cause or antecedent we cannot infer the absence of the effect or conse-

The converse of the rules is not true.

quent, for it may still be present owing to the presence of some other cause or antecedent. For example, from the absence of the sun we cannot conclude the absence of light, which may be due to some other cause, say fire. Similarly, from the presence of an effect or consequent we cannot legitimately infer the presence of the particular cause or ground mentioned in the given antecedent, for the effect or consequent may be due to some other agency or condition. We cannot, accordingly, infer the presence of the sun from the presence of light, for light may be caused by something else, such as the moon or fire.

Two forms of this reasoning; (a) Constructive and (b) Destructive.

The application of the first rule gives rise to what is called the *Constructive Form* of Hypothetical-categorical syllogisms, while the application of the second rule gives rise to the *Destructive Form.* Let us illustrate these remarks by reference to some examples :—

Examples.

| | |
|---|---|
| (1) If S is, P is ; | If there is rain, the ground is wet ; |
| S is ; | There is rain ; |
| ∴ P is. | ∴ The ground is wet. |

It is a constructive syllogism and valid according to Rule 1.

| | |
|---|---|
| (2) If S is, P is not ; | If James is honest, he will not tell a lie ; |
| S is ; | But James is honest ; |
| ∴ P is not.* | ∴ He will not tell a lie. |

* Even writers who hold that hypothetical propositions with negative consequents are negative, admit that this is an

It is also a valid constructive syllogism.

| | |
|---|---|
| (3) If S is not, P is; | If there is no rain, the ground is dry; |
| P is; | But the ground is dry; |
| ∴ S is not. | ∴ There has been no rain. |

It is an invalid constructive syllogism. On affirming the consequent, we cannot affirm the antecedent.

| | |
|---|---|
| (4) If S is not, P is not; | If there is no fire, there is no heat; |
| P is not; | But there is no heat; |
| ∴ S is not. | ∴ There is no fire. |

illustration of the first rule. If this be so, then the consequent which is affirmed is 'P is not,' and not 'P is.' We know, however, that when the sign of negative is taken to be a part of the consequent or predicate, the proposition is to be treated as affirmative. (*Vide* Chap. VI, § 1 and Chap. VII, § 4.) Dr. Ray more consistently lays down two different rules governing cases where the hypothetical major is negative. The rules are:— "(3) If you affirm the antecedent you may deny the consequent, but not conversely, that is, it is not allowed to affirm the antecedent on denying consequent. (4) If you affirm the consequent you may deny the antecedent, but not conversely, that is, it is not allowed to affirm the consequent on denying the antecedent." (*Text-Book of Deductive Logic*, p. 196.) And the following examples are given as illustrating these two rules:—

"In all cases, if A is, B is not,
"A is;
∴ "B is not.

"Here the hypothetical major premise is negative and the conclusion follows according to the third rule given above:

"In all cases, if A is, B is not;
"B is;
∴ "A is not.

"Here the hypothetical premise is negative and the conclusion is drawn according to the fourth rule given above." (*Ibid*, pp. 198-199.) These new rules and their exemplifications are, no doubt, adapted to the theory of negative hypothetical propositions. But if such propositions express only absence of dependence between the antecedent and the consequent, it is not clear how we can deny one on the affirmation of the other. If "the consequent does not depend on, or is independent of the antecedent," then surely we cannot infer anything about either of them when we know something of the other. (*Vide* Chap. VII, § 4.)

It is also fallacious on the same ground.

| | |
|---|---|
| (5) If S is, P is; | If the moon shines by its own light, it must always be full; |
| But P is not; | But it is not always full; |
| ∴ S is not. | ∴ It does not shine by its own light. |

It is a destructive syllogism, valid according to Rule 2. On denying the consequent, we may deny the antecedent,

| | |
|---|---|
| (6) If S is, P is not; | If there are clouds, the sun is not visible; |
| But P is; | But the sun is visible; |
| ∴ S is not. | ∴ There are no clouds. |

It is a valid destructive syllogism. The consequent has been denied, and so the antecedent has also been denied. (Rule 2.)

| | |
|---|---|
| (7) If S is, P is; | If there is fire, there is heat; |
| But S is not; | But there is no fire; |
| ∴ P is not. | ∴ There is no heat. |

It is an invalid destructive syllogism. We are not justified in denying the consequent on the denial of the antecedent.

| | |
|---|---|
| (8) If S is not, P is not; | If the middle term be not distributed, the conclusion cannot be valid; |
| But S is; | But the middle term is distributed; |
| ∴ P is. | ∴ The conclusion is valid. |

It is also fallacious on the same ground.

It may be mentioned in this connection that

hypothetical-categorical syllogisms can easily be reduced to pure syllogisms, either categorical or hypothetical; and their validity may then be tested by the different methods mentioned in Chapter XI. The first example (1) given above, may be reduced to the categorical form thus:

A case of the existence of S is a case of the existence of P;

This is a case of the existence of S;

∴ This is a case of the existence of P.

This is *Barbara* of the first figure.

It may also be reduced to a pure hypothetical syllogism. (*Vide* Chapter VII, § 3, Chap. X, § 8, and Chap. XI, § 18.)

Example (2) may be reduced to the categorical form thus:

No case of the existence of S is a case of the existence of P;*

This is a case of the existence of S;

∴ This is not a case of the existence of P.

This is *Celarent* of the first figure.

Example (7) stands thus when reduced to the categorical form.

A case of the existence of S is a case of the existence of P;

* The reduction of an affirmative hypothetical of this type to a negative categorical and *vice versa* are justified by the fundamental difference in the mode of thought underlying the two forms of judgment. Hypothetical propositions, as we have seen, are essentially affirmative in character. The change of an affirmative form to a negative or *vice versa* is justified by the laws of thought. It is proved by such forms of inference as obversion, contraposition, and inversion.

This is not a case of the existence of S ;

∴ This is not a case of the existence of P.

It involves the fallacy of the illicit process of the major term : 'a case of the existence of P' is distributed in the conclusion without being distributed in the premise.

(2) Disjunctive-categorical syllogisms have a disjunctive major, a categorical minor, and a categorical conclusion.

§ 3 (2) **Disjunctive-categorical Syllogism.** After what has been said about the character of a disjunctive proposition and its reduction to hypothetical and categorical forms, little need be added here. (*Vide* chap. VII, § 3 and Chap. X, § 8.) According to Mill, the members of a disjunctive proposition are so related that if one be false the other is true ; but not conversely. According to Ueberweg, however, the alternatives are mutually exclusive, so that if one be true, the other is false, and *vice versa*. Thus, generally the rule of this form of mixed syllogism is that *if a member of a disjunctive proposition* be denied, the other *must be affirmed*. And, when the alternatives are mutually exclusive (as in the case of contradictory terms), then the truth of one member may imply the falsity of the other.

Rules of inference.

Let us take a few examples :

| | |
|---|---|
| (1) S is either P or Q ; | James is either honest or wise ; |
| But S is not P ; | But James is not honest ; |
| ∴ S is Q. | ∴ He is wise. |
| (2) S is either P or Q ; | James is either honest or wise ; |
| But S is not Q ; | But James is not wise ; |
| ∴ S is P. | ∴ He is honest. |

| | |
|---|---|
| (3) S is either P or Q ; | James is either honest or dishonest. |
| But S is P ; | But James is honest ; |
| ∴ S is not Q. | ∴ He is not dishonest. |
| (4) S is either P or Q ; | James is either honest or dishonest ; |
| But S is Q ; | But James is dishonest ; |
| ∴ S is not P. | ∴ He is not honest. |

It should be noted that while the first two forms, [*viz.*, (1) and (2)] are generally true, the last two forms [*viz.*, (3) and (4)] are true only when the members of a disjunctive are mutually exclusive. It may also be mentioned here that a disjunctive-categorical syllogism may be changed into a hypothetical-categorical or into a pure syllogism, either categorical or hypothetical. (*Vide* Chap. X. § 8.)

(3) The Dilemma has a compound hypothetical as major and a disjunctive as minor premise, with a categorical or disjunctive proposition as conclusion.

§ 4. (3) **The Dilemma.** It is a mixed syllogism with a compound hypothetical major premise and a disjunctive minor, whose alternatives either affirm the antecedents or deny the consequents of the hypothetical major. The peculiarity of the dilemmatic argument is that its minor premise presents alternatives (apparently leaving no room for any other possibility) which drive the opponent to an equally unpleasant conclusion. And, since alternatives are thus affirmed or denied in the minor premise, these must have been mentioned in the major, in order that they may subsequently be so affirmed or denied. Thus, we find that the minor premise must be disjunctive, either affirma-

tive or negative, and the major, a compound proposition having the alternatives which are subsequently affirmed or denied in the minor. Again, as the dilemma proceeds on assumptions, offered for the acceptance of an adversary, the major premise must be a hypothetical proposition.

The dilemma (from Gr. *di*, double and *lemma*, an assumption), then, involves a double assumption, calculated to establish a conclusion distasteful to a person. An Athenian mother, for example, to dissuade her son from entering public life, presented the following dilemma to him : "If you act justly, men will hate you; and if you act unjustly, the gods will hate you; but you must do either what is just or what is unjust; therefore, by entering public life, you run the risk of being universally hated." Thus, as Mr. Read says, "A Dilemma is a Compound Conditional Syllogism, having for its Major Premise two Hypothetical Propositions, and for its Minor Premise a Disjunctive Proposition, whose alternate terms either affirm the Antecedents or deny the Consequents of the two Hypothetical Propositions forming the Major Premise." (*Logic*, p. 149.) Dr. Keynes, likewise, defines a dilemma as "A formal argument containing a premise in which two or more hypotheticals are conjunctively affirmed, and a second premise in which the antecedents of these hypotheticals are alternatively affirmed or their consequents alternatively denied." (*Formal Logic*, p. 363.) When the alternatives employed in a dilemma are more than two, it is

Dilemma defined by Mr. Read

and Dr. Keynes

known as a *trilemma*, a *tetralemma*, or a *polylemma*, according as the alternatives are three, four, or many in number.

From the preceding remarks it is clear that the dilemma is a mixed syllogism in which one is forced to the same conclusion whichever of the several alternatives proposed may be accepted. The alternatives assumed in the hypothetical major premise are known as **the horns of the dilemma**; and when the dilemma is urged against any one, he is said to be *placed between its horns*. If an attempt be made to refute a dilemma by a counter dilemma, such an attempt is described as **rebutting a dilemma**. A dilemma may be either (1) constructive or (2) destructive, according as the minor premise affirms or denies the alternatives mentioned in the major. And, in either case, a dilemma may be simple or complex, according as the conclusion is a categorical or a disjunctive proposition. It should also be noted that, in the constructive form, there must be more than one antecedent in the hypothetical major, which are disjunctively affirmed in the minor premise; while, in the destructive form, there must be more than one consequent in the major, which are disjunctively denied in the minor premise. The conclusion is categorical or disjunctive according as there is or is not a single antecedent or consequent in the hypothetical major. Let us illustrate these remarks by reference to examples.

The alternatives presented by a dilemma are called its horns.

A dilemma is said to be rebutted when it is refuted by a counter dilemma.

A dilemma is either constructive or destructive, each of which may be either simple or complex.

The conclusion is categorical or disjunctive, according as there is or is not a single antecedent or consequent in the hypothetical major premise.

Examples.

I. **Constructive Form.**

(1) *Simple*: If A is B, C is D; and if E is F, C is D;
But either A is B or E is F;
∴ C is D.

(2) *Complex*: If A is B, C is D; and if E is F, G is H;
But either A is B, or E is F;
∴ Either C is D, or G is H.

II. **Destructive Form.**

(1) *Simple*: If A is B, C is D; and if A is B, E is F;
But either C is not D, or E is not F;
∴ A is not B.

(2) *Complex*: If A is B, C is D; and if E is F, G is H;
But either C is not D, or G is not H;
∴ Either A is not B, or E is not F.

The formal correctness of a dilemma can be determined by testing its constituent hypothetical-categorical syllogisms by appropriate rules.

The formal correctness of a dilemmatic argument can be determined by resolving the dilemma into its constituent simple hypothetical-categorical syllogisms and then by testing them by appropriate rules. The complex constructive dilemma given above may, for example, be resolved thus:

| | |
|---|---|
| If A is B, C is D; | If E is F, G is H; |
| But A is B; | But E is F; |
| ∴ C is D. | ∴ G is H. |

Now, either A is B, or E is F;
∴ Either C is D, or G is H.

Similarly, the complex destructive dilemma given above may be analysed thus:

If A is B, C is D; If E is F, G is H;
But C is not D; But G is not H;
∴ A is not B. ∴ E is not F.
Now, either C is not D, or G is not H;
∴ Either A is not B, or E is not F.

If, in a dilemmatic argument, we transgress the rules of hypothetical-categorical syllogisms, then such an argument is to be treated as formally incorrect. Such fallacies arise, as we know, either from the denial of the antecedents or from the affirmation of the consequents in the minor premise. But dilemmas often involve material fallacies, since the alternatives chosen are in many cases not exhaustive. The following argument may be taken to illustrate such a fallacy. 'The promotion of learning by academical honours is useless. For, if a student be bent on study, he would study whether there be such honours or not; and if a student be not inclined to study, he would not take to it, in spite of such honours.' Here a third possibility is overlooked, *viz.*, students, not having a taste for study, may take to it when some artificial stimulus in the shape of academical honours is supplied. Hence the argument is fallacious. Fallacious dilemmas are often rebutted by counter dilemmas, in which the consequents of the major premise change places and contraries or contradictories are substituted for the terms used in the premises. The above dilemma may, for

Dilemmas involve material fallacies when the alternatives are not exhaustive.

An example.

Fallacious dilemmas are often rebutted.

example, be rebutted by the following argument :- 'Promotion of learning by academical honours is useful. For, to those who are bent on study, such honours will be an additional stimulus ; while, to those who are not so bent, the honours will constitute a real incitement.' The Athenian youth rebutted the dilemma of his mother thus : 'If I do what is unjust, men will love me ; and if I do what is just, the gods will love me. But I must do either what is just or what is unjust. Hence public life will endear me to all'. Let us mention in this connection two more classical instances of dilemma and the way in which they were rebutted.

Illustrations.

Concrete examples of dilemmas :

(1) The case of Protagoras and Euathlus.

Protagoras the sophist undertook to train Euathlus for the bar on the understanding that half the fee for instruction should be paid in advance and the other half when the pupil won his first case at the bar. Finding Euathlus reluctant to pay the rest of the fee by non-appearance in court as an advocate, Protagorus sued him and addressed him thus : 'Most foolish young man, whatever be the decision of the court, you shall have to pay the rest of the fee : if the court decide in your favour, you shall have to pay the fee according to the terms of contract ; and if, in mine, according to the decision of the court'. To this Euathlus retorted— 'Most sapient master, whatever be the decision, you lose your fee : if the court decide in my favour, then you lose it by the decision of the court ; and if, in yours, by the terms of the contract (as then I shall not have gained my first case).' Bowen observes

on this dilemma, "The Dilemma is here correct in Form, but there is a Material Fallacy in the Major Premise, since the Disjunction is not complete. There is a third horn to it, as Protagoras had no right, under the contract, to invoke the judgment of the court at all, so that the judges ought to have dismissed the case without a hearing. *Before a judgment was rendered*, Protagoras had no ground of action". (*Logic*, p. 217.) It may further be observed that Euathlus appeared in the suit not as an advocate but as a defendant.

(2) The case of a mother and a crocodile.

A similar dilemma is illustrated in the following: A crocodile having seized a child told its mother that he would return it if she could tell him aright whether he wanted to give it back. The mother, after anxious thought, said, 'You will not give it back'; and argued thus: 'Now, you must give it back: If my statement be true, then according to your promise; and if my statement be false, then to prove its falsity.' But the crocodile rejoined, 'I cannot give it back, for if I did I should break my promise by acting according to your false statement; and, were the statement true, I could neither give it back, as that would make it false' No doubt, the dilemma of the mother was weak: it was due to her apprehension that if she said 'You will give it back,' he would prove her answer false by not giving back the child. But really the dilemma would, then, have been stronger, as in such a case the restoration of the child would have been consistent at once with the truth of her statement and the terms

of the crocodile's promise. "There is," says Lotze, "no way out of this dilemma : as a matter of fact, however, both parties rest their cases on unthinkable grounds ; for the answer really given can as little be true or untrue independently of the actual result as could the answer she might have given, an answer which only differs from this in being more fortunate." (*Logic*, Eng. Trans., II, p. 20.)

The rules of the dilemma.

From the preceding remarks it is clear that a dilemma to be valid must conform to the following rules :

(1) The major premise must be a hypothetical proposition with more than one antecedent, or more than one consequent, or more than one of both.

(2) The minor premise must be a disjunctive proposition and must either affirm the antecedents or deny the consequents.

(3) The conclusion must be the same (in simple forms) or analogous (in complex forms), being offensive or paradoxical, whichever of the alternatives in the disjunctive premise be true.

(4) The alternatives must be exhaustive, not ignoring any intermediate possibility.

(5) The connection between the antecedent and the consequent must be real and not fictitious or false.

The first three of these rules ensure formal correctness ; and the last two, material truth.

§ 5. **Hints for Solving Problems.** (1) In a hypothetical proposition, the antecedent and the con-

sequent should be carefully distinguished before any conclusion is drawn or tested. Sometimes the order may be reversed in popular speech, *e. g.*, I shall be happy, if you come. As in the case of other propositions, so here, the sense, and not the form, should be the guide in determining which is antecedent and which, consequent.

(2) In a disjunctive proposition the character of the alternatives—whether mutually exclusive or not—should be determined before conclusions are drawn or tested.

(3) In testing a dilemmatic argument we should resolve it into its constituent syllogisms and test them by appropriate rules. The material truth of such an argument should be ascertained, wherever possible, by reference to the relation of the antecedent and the consequent in the major, and the character of disjunction involved in the minor premise.

*Illustrations.*

1. Test the argument.

I shall go out, when there is rain;
But there is no rain;
∴ I shall not go out.

Reduced to logical form the argument stands thus:

If there be rain, I shall go out;
But there is no rain;
∴ I shall not go out.

It involves the fallacy of denying the antecedent.

(2) Examine the argument:

James is either idle or thoughtless;
But he is thoughtless;
∴ He is not idle.

As the alternatives here are not incompatible or mutual-

ly exclusive, we cannot deny one alternative on the affirmation of the other. So the argument is fallacious.

(3) Test the following :—

If a man is honest, he prospers ; and if he is honest, he is honoured ;

But James either prospers or is honoured ;

∴ James is honest.

The argument may be analysed thus :

| | |
|---|---|
| (*a*) If a man is honest, he prospers ; | (*b*) If a man is honest, he is honoured ; |
| But James prospers ; | But James is honoured ; |
| ∴ James is honest. | ∴ James is honest. |

Both these syllogisms are incorrect, as the conclusions are arrived at by the affirmation of the consequents. So the argument is fallacious.

(4) Examine the following argument :—

If it is fated that you shall recover from your illness, then you will recover whether you call in a doctor or not ; and if it is fated that you shall not recover, then, with or without a doctor, you will not recover.

But you are fated either to recover or not to recover.

Therefore, it will be of no use to call in a doctor.

This is a dilemma framed by Cicero to illustrate the *Ignava Ratio,* or do-nothing argument, connected with fatalism. As Cicero himself points out, this argument would reduce the whole life to a state of inactivity or torpor. The argument is evidently fallacious, as the alternatives do not exhaust all possibilities. One may, for example, be fated to recover, *if* he calls in a doctor ; and the failure to summon a physician may thus lead to an unfavourable result. Fatalism, rightly understood, implies a necessary connection between certain antecedents and consequents, so that when the antecedents vary,

the consequents vary also. Abstractly viewed, fatalism may lead to extravagant, and even inconsistent, issues. Thus, Zeno appropriately replied, when he was chastising a slave, who pleaded in excuse for theft that it was fated for him to steal,—"And so it is for me to whip you."

## § 6. Exercises.

1. Distinguish between Pure and Mixed Syllogisms and indicate their different forms.

2. Explain and illustrate the rules of Hypothetical-categorical syllogisms. Are these rules consistent with the supposition that some hypothetical propositions are negative?

3. Determine the character of the Dilemma. What are its horns? When can it be said to be rebutted?

4. Examine the following arguments:—

(*a*) If he is well, he will come; but he is not well; therefore, he will not come.

(*b*) If the ship spring a leak she will either settle down or capsize. She has neither settled down not capsized. Therefore, she has not sprung a leak.

(*c*) John is wise, if he is learned. As, however, he is wise, he must be learned.

(*d*) If spirits existed they would affect our senses in some way or other.

(*e*) No one should be punished if he is innocent; this man should not be punished; therefore, he is innocent.

(*f*) Man, apart from society, would be either a god or a beast; but man is neither.

(*g*) A successful author must be either very industrious or very talented; Gibbon was very industrious; therefore, he was not very talented.

(*h*) If all the accused were innocent, some at least would have been acquitted; we may infer, then, that none were innocent, since none have been acquitted.

(*i*) If a man is insane or under seven years of age, he is

not responsible for his acts ; but James is neither : therefore, he is a responsible agent.

(*j*) If virtue were knowledge, it would be capable of being taught ; but where are the teachers of virtue ?

(*k*) Logic is either a science or an art ; it is a science ; therefore, it is not an art.

(*l*) An emperor is admirable either for his military skill or for his political wisdom. Akbar was admirable for his political wisdom. Therefore, he cannot have been remarkable as a military leader.

(*m*) If I am destined to pass the examination, I shall pass even if I do not answer any of the questions ; and if I am not destined to pass, I shall not pass, even if I answer them all. Thus, it is quite useless to answer the questions.

(*n*) A land army is unnecessary to an inland country ; for, if its navy holds the sea, there is nothing for the army to do ; and if its navy is driven from the sea, there is nothing that its army can do (to save the country from starvation).

(*o*) If virtue is voluntary, vice is so ; but vice is voluntary ; therefore, virtue also must be voluntary.

(*p*) If men have free-will, they are responsible for their actions ; but men have no free-will ; therefore, they are not responsible for their actions.

(*q*) Logic is indeed worthy of being cultivated, if Aristotle is to be regarded as infallible ; but he is not : Logic, therefore, is not worthy of being cultivated.

# CHAPTER XIII

## IRREGULAR AND COMPOUND SYLLOGISMS.

The logical order of premises and conclusion is often reversed in practice.

§ 1. **Irregular Syllogisms.** The proper form of syllogistic argument is to state the premises in due order and then to establish the conclusion which necessarily follows from them. Though, however, this is the logical order, yet, as a matter of fact, we seldom take the trouble of putting our arguments in the strict logical form. In practice, we often state the conclusion first, as it is spontaneously suggested to the mind by previous experience, and then adduce reasons to support our view. We may say, for example, that 'John is clever, for he has got over these difficulties, as clever men always do'; or, that 'This mango is sweet, for it belongs to the species of *Bara Sinduria*, and such mangoes are always sweet.' And generally we find that the conclusion is thus psychologically prior, though logically it is posterior, to the premises. Psychologically the conclusion is often presented to the mind first; and premises are next advanced by way of after-thought to support the conclusion. But though this indicates the usual form of reasoning, yet, to determine its validity, we must reduce it to the logical form. When we reduce the above examples to the logical form we find that the first is invalid, involving the fallacy of undistributed middle,

while the second is valid, being in the mood *Barbara.*

When a premise or conclusion is obvious, it is genrally suppressed in ordinary speech.

Often we find one of the premises or the conclusion to be so obvious, that we hardly think it necessary to explicitly state it. We say, for example, that 'John is mortal, for he is a man'; or that 'Lawyers are shrewd and James is a lawyer.' In the former example, the major premise 'Man is mortal' is supposed to be so familiar a truth, that it is regarded as superfluous, if not pedantic, to explicitly mention it. Similarly, in the latter case, the conclusion, 'James is shrewd', so manifestly follows from the given premises that it is thought quite unnecessary to state it formally. Such an incomplete syllogism with some its parts suppressed is called an Enthymeme. In an enthymeme, either one of the premises may be suppressed or the conclusion may be left out. In the former case, either the minor or the major premise may be formally stated, while the other is held in the mind.* Thus, enthymemes are generally regarded as of three kinds or varieties. (1) An enthymeme is said to be *of the first order* when the major premise is suppressed; *e.g.*, 'John is sure to succeed, for he is both intelligent and industrious.' Here the major premise 'All men who are both intelligent and industrious succeed' is unexpressed. (2) An enthymeme is taken to

An incomplete syllogism is known as an Enthymeme.

*Four orders of Enthymemes:*

(1) In the first order, the major premise is suppressed;

(2) in the second, the minor;

* The word, '*Enthymeme*' comes from Gr. *en*, in, and *thymos*, mind, implying that some knowledge is kept in the mind, as an unexpressed premise or conclusion, which is explicitly stated only when the syllogism is fully expressed.

be *of the second order* when the minor premise is suppressed; *e. g.*, 'Feather has weight, as all material bodies have weight.' Here the minor premise, 'Feather is a material body,' is left understood. (3) An Enthymeme is viewed as *of the third order* when the conclusion is suppressed; *e. g.*, 'Cobras are poisonous and this is a cobra.' Here the conclusion 'This is poisonous' is suggested, but not expressed. (4) To these three forms, we may add a fourth in which only a premise or the conclusion is formally stated, the other parts being left understood owing to their obviousness. For example, finding a man leading a depraved life we may say, 'He is doomed to destruction'; or, to excuse the weakness of an individual in any case, we may simply exclaim, 'Human nature is frail'. In the former case, the premises 'Men leading a depraved life are doomed to destruction and this man leads such a life' are both suppressed; while in the latter, the premise, 'This individual is human', and the conclusion, 'Therefore, he is frail,' are both unexpressed. We may call such an incomplete syllogism *an enthymeme of the fourth order*. For directions to complete an incomplete syllogism see section 5.

(3) in the third, the conclusion;

and (4) in the fourth, both the premises or a premise and the conclusion.

**§ 2. Train of Syllogistic Reasoning.** When two or more syllogisms are so connected together as to justify a single conclusion, these constitute what is called a Train of Syllogistic Reasoning. When, for example, the following syllogisms are combined together, we get a train of

A combination of syllogisms yielding a final conclusion is known as a Train of Syllogistic Reasoning.

reasoning, in which the final conclusion is determined by the prior syllogisms. For example,

(1) All A is B,
All B is C,
∴ All A is C;
(2) All A is C,
All C is D,
∴ All A is D;
(3) All A is D,
All D is E,
∴ All A is E.

Two forms of such a train:

In this train, the conclusion of the first syllogism becomes a premise of the second; and the conclusion of the second becomes a premise of the third. The final conclusion is thus determind by all the preceding syllogisms. This form of the train, in which the final conclusion is given last, is known as Progressive, Synthetic, or Episyllogistic.

(1) Progressive, Synthetic, or Episyllogistic.

Meanings of Prosyllogism and Episyllogism.

In the above train of reasoning, the first syllogism is called a prosyllogism in relation to the second, and the second is called a prosyllogism in relation to the third. The second syllogism, on the other hand, is called an episyllogism in relation to the first, and the third, an episyllogism in relation the second. A *Prosyllogism* is one of which the conclusion forms a premise of another syllogism, which is called an episyllogism in relation to it. Similarly, an *Episyllogism* may be defined as a syllogism of which a premise is the conclusion of another syllogism, which is known as a prosyllogism with reference to it. Thus, the

**These are relative terms.**

terms prosyllogism and episyllogism are entirely relative. One and the same syllogism may be a prosyllogism with regard to another and an episyllogism in regard to a third. In the above example, for instance, the second syllogism is an episyllogism with reference to the first, though it is a prosyllogism with reference to the third.

**Episyllogistic should not be confounded with Episyllogism**

In the above train of reasoning the argument proceeds from a prosyllogism to an episyllogism; and hence the train is known as *Episyllogistic.* The term episyllogistic should not be confounded with the term episyllogism. One is a train of reasoning, while the other is but a constituent part of it. An Episyllogistic Train of Reasoning is also known as *Progressive*, as the reasoning continually advances from premises to conclusion until we arrive at a final result. It is also known as *Synthetic*, as it involves a synthesis or combination of serveral premises justifying the final conclusion.

**(2) Regressive, Analytic or Prosyllogistic.**

There is another kind of train of reasoning which is known as Regressive, Analytic, or Prosyllogistic. This may be illustrated by the following example:—

| | |
|---|---|
| (1) All A is B, | |
| ∵ All K is B———— | (2) All K is B, |
| and All A is K. | ∵ All M is B |
| (3) All A is K, | and All K is M. |
| ∵ All S is K | |
| and All A is S. | |

In this train of reasoning, the final conclusion is put first; and reasons are next advanced for proving it. These reasons again are next proved by other syllogisms, all tending to support the first. As in this train of reasoning the argument proceeds from an episyllogism to a prosyllogism, it is called *Prosyllogistic.* It is also known as *Regressive*, as we move backwards, discovering reasons for the final conclusion mentioned at the outset. It is known also as *Analytical*, as it involves the discovery of the reasons justifying the final conclusion by analysis. In this train of reasoning, the first syllogism is an episyllogism with regard to the second and the third, while these are prosyllogisms in regard to the first.

A train may be more or less complex according to the number of syllogisms constituting it.

A train of syllogistic reasoning, whether analytical or synthetical, may be more or less complex, according to the number of syllogisms entering into it. In the illustrations given above only three syllogisms compose the train in each case. Such a train, however, may be made up of more than three or even of two syllogisms. The validity of a train is to be determined by the validity of the constituent syllogisms. If any one of these be invalid, the whole train is taken as invalid, as the final conclusion is not justified in that case by the premises. We should also remember in this connexion that if any one of the constituent syllogisms of a train be in any other figure than the first, then the train of reasoning is taken to be in that figure. The following train,

Its validity depends on the validity of its constitent members.

for example, is in *Cesare*, as the third syllogism of the train is in *Cesare* of the second figure :

(1) All A is B,
All B is C,
∴ All A is C ;
(2) All A is C,
All C is D,
∴ All A is D ;
(3) All A is D,
No E is D,
∴ No A is E.

**§ 3. Abridged Forms of Trains of Syllogistic Reasoning.** A train of syllogistic reasoning may be either fully expressed or abridged by the suppression of some of its parts. In the first train of syllogistic reasoning given above, if all the conclusions except the last, and the corresponding premises, be suppressed, we get a condensed synthetic train of reasoning, which is known as **Sorites** Similarly, if, in an analytical train, some of the premises of its prosyllogisms be suppressed, we get a condensed form which is known as **Epicheirema.** Let us consider these two forms of condensed trains of reasoning one by one.

A Sorites is an abridged synthetic train of reasoning,

while an Epicheirema is an abridged analytical train.

**§ 4. Sorites.** A Sorites, as explained above, is a Condensed Train of Synthetic Reasoning with all the conclusions except the last (and the corresponding premises) suppressed. It is a progressive train, abridged by the omission of the conclusions of its prosyllogisms. The following is an example of sorites :

Sorites defined.

An example,

(1) All A is B,
All B is C,
All C is D,
All D is E,
All E is F,
∴ All A is F.

expanded into a fully expressed train.

It may easily be expanded into a fully expressed train of reasoning when the suppressed premises and conclusions are supplied. When expanded it stands thus :—

| | |
|---|---|
| (1) All A is B, | (3) All A is D, |
| All B is C, | All D is E, |
| ∴ All A is C ; | ∴ All A is E ; |
| (2) All A is C, | (4) All A is E, |
| All C is D, | All E is F, |
| ∴ All A is D ; | ∴ All A is F. |

The validity of a sorites depends in every case upon the validity of its constituent syllogisms.

*Two forms of Sorites :*

(1) Aristotelian,

(2) Goclenian.

A sorites may be of either of two distinct forms. The form given above is known as *Aristotelian Sorites.* In it the conclusion of a prosyllogism becomes the minor premise of the next episyllogism, until we arrive at a final conclusion. In another form of sorites the conclusion of a prosyllogism becomes the major premise of the next episyllogism, until the final conclusion is reached. The following is an example of this form of sorites, which is known as *Goclenian* :

All E is F,
All D is E,
All C is D,
All B is C,
All A is B,
∴ All A is F.

In a sorites of the first figure only one premise can be particular or negative.

We should remember in this connexion that only one premise in a sorites of the first figure can be particular or negative. If more than one premise be particular or negative, then ultimately we get the fallacy of two particular or negative premises. We should also remember in this connexion that in the Aristotelian sorites only the first premise can be particular; and in the Goclenian, the last. In the Aristotelian form only the last premise can be negative; and in the Goclenian, only the first. If any other premise be particular, there arises the fallacy of undistributed middle in some of the constituent syllogisms; and if any other premise be negative, there arises likewise the fallacy of illicit process of the major.

Epicheirema defined.

§ **5. Epicheirema** A Condensed Train of Analytical Reasoning gives rise to what is known as Epicheirema. It is a regressive train of reasoning, abridged by the omission of one of the premises of its prosyllogisms. In an epicheirema, a syllogism is given, the premises of which are proved by enthymemes. An epicheirema may be (1) either Simple or (2) Complex. (1) In the simple form, the premises of an episyllogism are proved by enthymemes. In this case, an epicheirema may be (*a*) single or (*b*) double, according as one or both of the premises of the episyllogism are proved by enthymemes. The following are examples of the different forms of epicheirema :—

An epicheirema may be (1) simple or (2) complex.

Simple epicheirema is either (*a*) single or (*b*) double.

Illustrations.

1. *Simple Form* :

(a) *Single* : All A is B, because All C is B and All A is C.

And All C is B, because All D is B.

(b) *Double* :

All A is B, ∵ All C is B and All A is C.

All C is B, ∵ All D is B;

and All A is C, ∵ All A is F.

Four forms of single or double epicheirema.

In the case of a simple epicheirema, a reason is given for a premise or each of the premises of the final episyllogism, and this reason may be either the major or the minor premise. Thus, there are four possible forms of the single or the double epicheirema.

2. *Complex Form.* All A is B, because All D is B and All A is D; All D is B, because All X is B; and All X is B, because All Z is B.

This argument when expanded stands thus :

| | | |
|---|---|---|
| (1) All D is B ; | (2) All X is B ; | (3) All Z is B ; |
| All A is D ; | All D is X ; | All X is Z ; |
| ∴ All A is B. | ∴ All D is B | ∴ All X is B |
| | (original major.) | [major of (2)]. |

In this example, reasons for the major premises of episyllogisms are given ; and the reasons themselves serve in this case as major premises of the prosyllogisms. Similarly, reasons for the minor premises of episyllogisms may be given, and these reasons may themselves be the minor premises of the prosyllogisms. The complexity increases as reasons for the different premises are differently combined ; and if an enquiry into the reasons be pushed to a great length, the complexity becomes

The complexity of an epicheirema increases with the addition of reasons.

very great. An epicheirema may thus be extended to an indefinite length when reasons are multiplied for the reasons themselves.

Classification of Trains of Syllogistic Reasoning.

**§ 6 Tabular View of Trains of Syllogistic Reasoning.** The Trains of Syllogistic Reasoning, as explained above, may be classified in a tabular form thus :

- Trains of Syllogistic, Reasoning
  - Progressive, Episyllogistic, or Synthetic
    - Fully Expressed.
    - Condensed (Sorites) ..
      - Aristotelian.
      - Goclenian.
  - Regressive, Prosyllogistic, or Analytic
    - Fully Expressed.
    - Condensed. (Epicheirema) ..
      - Simple.
        - Single
        - Double.
      - Complex.

## § 7. Hints for Solving Problems.

1. To test the correctness of an enthymeme, we are to supply the suppressed proposition or propositions, and then to test the validity of the reasoning by the syllogistic rules. To supply the proposition or propositions, wanted to complete the argument, we are to remember the following points :—

(*a*) Each term in a syllogism occurs twice : the middle term occurs in both the premises, and the minor or the major term in a premise and the conclusion. Thus, when two propositions are given we are to supply a third with those terms which occur but once in the given

propositions. (*Vide* Chap. XI, § 2.) Take, for example, the enthymeme—No S is P, because All S is M. Here we are to supply the other premise with the terms M and P, which occur only once in the given propositons. Thus, the premise needed is No M is P or No P is M. This premise is evidently the major, as the major term P is present in it. So it is an enthymeme of the first order. In any case, we can determine whether the premise supplied is the minor or major, as the subject or the predicate of the conclusion is present in it. Thus, we can ascertain whether an enthymeme is of the first or the second order.

(*b*) We should remember that if the conclusion is negative, one of the premises must be negative ; and if the conclusion is universal, then both the premises must be universal. We are to supply the suppressed proposition consistently with these rules.

(*c*) We should supply the suppressed propositions in such a way as to avoid the fallacies of undistributed middle and illicit process.

(*d*) We should not hastily pronounce a combination of propositions as invalid without satisfying ourselves that a conclusion cannot possibly be drawn from them. For example, in the following combination seemingly no conclusion follows, both the premises being negative and there being apparently no middle term :—

No not-B is A, , . . . . . . . (1)
and No B is C . . . . . . . . (2)

But, by changing the premises by some forms of immediate inference, we can draw a conclusion thus :

By converting (1) we get No A is not-B......(3)
By obverting (3) we get All A is B..........(4)
By combining (2) and (4) we get

No B is C ;
All A is B ;
∴ No A is C or No C is A.

2. In testing a train of syllogistic reasoning, we are to examine the validity of each constituent syllogism. If any one of them be incorrect, the whole train is to be regarded as invalid.

3. In testing a Sorites or an Epicheirema we are to resolve it into its component syllogisms and examine their correctness. If any one be invalid, the whole train is fallacious.

*Illustrations.*

1. Examine the following arguments :—

(*a*) No imperfect beings are happy, and no unhappy beings are contented.

(*b*) James is upright, for only strict men are upright.

(*c*) John is not a Puritan, for the Puritans alone hold such views.

(*a*) Here the premises are given; we are to see whether any conclusion follows.

No imperfect beings are happy...(1) and
No unhappy beings are contented...(2).

By converting (1) we get, No happy beings are imperfect....(3)

By obverting (3) we get, All happy beings are perfect....(4)

By converting (2) we get, No contented beings are unhappy....(5)

By obverting (5) we get, All contented beings are happy....(6)

By combining (4) and (6) we get,

All happy beings are perfect,
All contented beings are happy ;
∴ All contented beings are perfect.

It does not transgress any rule. It is valid in the mood *Barbara.*

(*b*) Here we are to supply a premise with 'James' and 'strict men,' which occur but once in the given premise and conclusion. As the conclusion is affirmative, the premise to be supplied must be affirmative; and as 'James' is distributed in the conclusion, it should be distributed in the premise. So 'James,' should be the subject of an A proposition. Thus, the suppressed premise is found to be 'James is strict.' Now the given premise is 'Only strict men are upright,' which is equivalent to 'All who are upright are strict.' (*Vide* Chap. VII, § 8.) The syllogism, therefore, stands thus:

All who are upright are strict;
James is strict;
∴ James is upright.

Here is the fallacy of undistributed middle, as the middle term 'strict,' is not distributed in any premise, being the predicate of affirmative propositions. It is an enthymeme of the second order.

(*c*) Here we are to supply a premise with 'John' and 'Those who hold such views,' which occur only once in the given premise and the conclusion. As the conclusion is negative and the given premise is affirmative, the premise to be supplied must be negative. (Syllogistic Rule 6.) And, as the conclusion is universal, the premise to be supplied should be E. Thus, the suppressed premise is found to be 'John is not one who holds such views.' And the given premise is equivalent to 'All who hold such views are Puritans.' So the syllogism stands thus:

All who hold such views are Puritans;
John is not one who holds such views;
∴ John is not a Puritan.

It involves the fallacy of the illicit process of the major term, since the term 'Puritan' is distributed in the negative conclusion without being distributed in the predicate of the affirmative premise.

2. Test the following arguments :—

(*a*) The news is too good to be true.

(*b*) All A is B, All B is C, No C is D, All D is E; therefore, No A is E.

(*c*) All X is Y, because All Z is Y and all X is Z; and All Z is Y, because All S is Z.

(*a*) The statement means that the news is so very good that it is not likely to be true. The conclusion, then, is that 'The news is not likely true'; and the reason is 'The news is very good.' The argument is thus an enthymeme of the second order. The conclusion being universal and negative, the premise to be supplied must be so. The premise should, therefore, be 'No very good news is true.' The argument, accordingly, assumes the following syllogistic form :

No very good news is true,
This is a very good news,
∴ This is not true.

It is a valid syllogism in *Celarent*.

(*b*) This is an Aristotelian Sorites. It may be expanded into a train thus :

| | | |
|---|---|---|
| (1) All B is C, | (2) No C is D, | (3) All D is E; |
| All A is B, | All A is C, | No A is D; |
| ∴ All A is C; | ∴ No A is D; | ∴ No A is E. |

Here in the last syllogism (3), the major term E is distributed in the conclusion, without being distributed in the premise. Thus, there is the fallacy of the illicit process of the major term. So the sorites is incorrect.

(*c*) It is a single epicheirema. It may be expanded thus :—

| | |
|---|---|
| (1) All Z is Y, | (2) All S is Z, |
| All X is Z, | All Y is S (or All S is Y), |
| ∴ All X is Y. | ∴ All Z is Y. |

Here in the prosyllogism [*i. e.*, in (2)] the minor term 'Z' is distributed in the conclusion without being distributed in the premise. Thus, there is the fallacy of the illicit process of the minor term. So the epicheirema is wrong.

## § 8. Exercises.

1. What do you understand by an Enthymeme? Indicate its different forms. Describe the method of supplying the suppressed premise of an Enthymeme.

2. Distinguish between a Syllogism and a Train of Syllogistic Reasoning. Explain and illustrate the different forms of the latter.

3. Distinguish between (*a*) a Prosyllogism and an Episyllogism, (*b*) a Sorites and an Epicheirema; and (*c*) a Goclenian and an Aristotelian Sorites.

4. Show that only one premise in a Sorites can be particular and only one negative. Prove which of the premises can be particular, and which negative.

5. Explain the different forms of the Epicheirema, illustrating your answer by examples.

6. Reduce the following arguments to their logical forms and examine their correctness.

(1) This poor child's life is precious because human life is precious.

(2) These merit our respect for they are honest men.

(3) He is too honest to be worldly successful.

(4) There must have been a heavy fall of snow on the mountains, the weather is so cold.

(5) Dauson was not penniless, therefore he was not bribed.

(6) If I had read as much as my neighbours, I should have been as ignorant.

(7) The present universe began in time, and will in time come to an end.

(8) There have been astronomers who were mere mathematicians; and there have been mathematicians who were mere calculating machines.

(9) Death is nothing terrible; if it were so, it would have appeared so to Socrates.

(10) Since on the moon there is neither air, water, frost, nor organic matter, the causes of disintegration and change are absent.

(11) The complete development of a being is its highest good. But complete development can be attained only through independence, and independence is possible only to members of a state. Therefore, man is naturally a political animal.

(13) Exact and extensive knowledge cannot be attained without cramming, and cramming is a thing always to be avoided.

(13) The world cannot be eternal, because it is not perfect.

(14) All novelty is injury, for it defaces the present state of things.

(15) Sound citizenship supposes a power of exact and impartial analysis of facts, and this power is acquired by scientific study.

(16) If spontaneous generation is not possible now, it could never have been possible.

(17) Meteoric stones sometimes contain hydro-carbon compounds, and all hydro-carbon compounds are products of vegetable life.

(18) All life, Hobbes argues, is activity; all activity arises from want; and therefore from suffering.

(19) Novel reading has no doubt a soothing effect; but what is soothing is often enervating, and therefore to be avoided.

(20) The frequent blunders in assessment that are taking place prove that valuation is not an exact science.

(21) The sky being cloudy, the day is sultry.

(22) The colouring substance cannot be blood ; it is soluble in benzol.

(23) He has broken his word, which no honest man ever does.

(24) All grasses have parallel-veined leaves, and so has the bamboo.

(25) That is a bee ; do not touch it ; it will sting you.

(26) The atmosphere after a thunderstorm must abound in ozone, because ozone is produced by the passage of electric sparks through the atmosphere.

(27) As industrious men are successful, James must be industrious.

(28) No dishonest men are virtuous ; and the covetous are not honest.

(29) James is not happy, for he is envious.

(30) All mortals are created ; and no immortal beings are men.

## CHAPTER XIV.

### FUNCTIONS AND VALUE OF THE SYLLOGISM.

§ 1. **Inference Involves Advance in Knowledge.** In every case of inference we proceed from truths with which we are familiar to those that were previously obscure to us. We have seen that, even in the case of educations, truths are revealed by the inferential process which were not clear to us before. In the case of the syllogism, the conclusion, being the joint product of the two premises, was evidently not present in the mind when the premises were stated. We shall see in the next Book (Book III) that in the case of Inductive Inference the advance in knowledge is still more patent. Thus, in every real inference, there is a progress in knowledge—a learning of something which was not known before.

Every form of inference involves a passage from the known to the unknown, from reasons to conclusion.

In some cases, however, when we apparently reason, we really assume what we intend to prove. Thus, Molier's physician explained the sleep-producing property of opium by reference to its soporific virtue; and we not infrequently explain to a child that we can see through glass because it is transparent. Such reasonings are evidently no reasonings at all, since what we want to prove or explain we already assume in some other form of expression: 'Soporific' is the same

When the conclusion is assumed in a premise, the reasoning is fallacious, technically called a *petitio pricipii.*

as 'sleep-producing,' and 'transparent' is the same as 'pervious to light.' Similarly when we argue—

| | |
|---|---|
| (1) *All A is B*, | (2) All A is C, |
| All B is C, | All C is B, |
| ∴ All A is C, | ∴ *All A is B*, |

we assume as the minor premise of the first syllogism what we subsequently prove in the second. As such forms of reasoning contradict its very essence, they are treated as fallacious. And the fallacy in this case is technically known as *Petitio Principii* or Begging the Question. It means that we unjustifiably assume in a premise what we want subsequently to establish in the conclusion.

**§ 2. Does the Syllogism Involve a Petitio Principii?** Let us discuss this question in connection with the objections which have been urged by Mill against the syllogistic argument. His objections are:—

Mill's objections to the syllogism:

(1) The syllogism is not the ordinary form of inference; ordinarily we reason from particulars to particular.

(1) The syllogistic form of reasoning does not represent the ordinary form in which we reason in the actual affairs of life. Ordinarily we argue from particulars to particular. Observing, for example, that unsupported material bodies fall to the ground, say, in twenty instances, we conclude in the twenty-first instance of an unsupported body that it also would fall to the ground. We never take the trouble of putting the argument in the syllogistic form: we never mention that 'All material bodies when unsupported fall to the ground; this is a material body; ∴ this also falls to the ground.' It is only in doubtful cases that we take the trouble of stating

the universal premise justifying the conclusion. Thus, according to Mill, the syllogism is merely a test to be employed to examine the validity of doubtful instances of reasoning. It is never the ordinary form of argument. Ordinarily we argue from particulars to particular.

(2) The second objection of Mill is that, as a form of reasoning, the syllogism involves the fallacy of *petitio principii* or begging the question. It is urged that a syllogism never establishes a new truth: it merely repeats what is already contained in the universal premise. When, for example, we argue that 'All men are mortal, John is a man, therefore, John is a mortal', we practically assume the conclusion when we state the universal premise: the proposition 'All men are mortal' can never be true, unless the conclusion 'John is mortal' is also true. The conclusion, therefore, is not really arrived at from the premises; it is taken for granted in the universal premise itself. Thus, the syllogism, according to Mill, involves the fallacy of petitio principii. The proper function of the syllogism, according to him, is merely to test the correctness of ordinary inferences from particulars to particular, whenever there is any doubt of their validity.

**(2) The syllogism as a mode of reasoning involves the fallacy of *petitio principii*.**

**The conclusion is assumed in the universal premise.**

The above objections of Mill are, however, not tenable.

**But the objections are groundless.**

(1) With regard to the first objection it may be said that Mill confounds the business of Psychology with that of Logic. Psychology as a posi-

**(1) Mill confounds the business of**

Logic with that of Psychology.

tive science examines the mental processes as they actually take place in the human mind; while logic as a normative science is concerned with the 'norm,' standard, or ideal which should regulate our thoughts in order that they may be free from error and fallacies. When Mill tells us that the syllogism does not represent the common form of reasoning, he evidently refers to a positive science, instead of to a normative one. Logic has nothing to do with the ordinary forms of reasoning, which may be valid or invalid. It is concerned only with the ideal or type, which should regulate our reasoning processes in order that they may be valid. Though syllogism may not be the ordinary form of reasoning, yet its importance as a test of correct reasoning should never be under-estimated.

Logic is concerned only with the ideal or correct form of reasoning.

(2) The conclusion is not known when the universal premise is stated.

(2) The second objection of Mill is also groundless. The truth of the conclusion is not present in the mind when the universal premise is stated. When, for example, it is mentioned that 'All men are mortal,' the particular case of the mortality of John may not be present before the mind. A universal proposition does not necessarily involve a knowledge of the truth of all the particular instances coming within its sweep. It would be absurd to suppose that, in the case of a universal proposition, all its varied applications are present in the mind; and nothing can be more preposterous or prejudicial to scientific inquiry than to insist that all the individual instances must be known before a general truth can

be asserted. In fact, Mill himself mentions that an inductive generalization proceeds from the known to the unknown—from some instances observed to all like instances. If this be the true character of a general proposition, then the conclusion is not necessarily known when the universal premise is stated. The infinity covered by the universal premise is vague enough to preclude a direct definite knowledge of a particular case. The truth of the above remarks is patent from the fact that the conclusion can never be drawn from the universal premise alone, but from the two taken together. One may be aware, for example of the general proposition 'All men are mortal' and yet he cannot infer the mortality of 'John' without being previously aware that 'John is a man.' When both the propositions 'All men are mortal' and 'John is a man' are known, then—and then alone—are we justified in concluding that 'John is mortal.' The truth of the conclusion, therefore, is not necessarily involved in the universal premise; and so the objection of Mill that the syllogistic inference involves the fallacy of *petitio principii* is not tenable.

The universal premise is too general to imply a definite knowledge of a particular instance.

Moreover, the conclusion follows, not from the major premise alone, but from the major and the minor taken together.

**§ 3. Versions of Aristotle's Dictum.** Different versions have been given of Aristotle's *Dictum de omni et nullo ;* and we shall consider here which of these versions leaves the syllogism less open to the charge of *petitio principii.** *Whately's*

Which version of Aristotle's Dictum leaves the syllogism less open to the charge of petitio principii ?

* "State the Dictum of Aristotle (*a*) as translated by Whately, (*b*) as rendered by Mill; and show which of these two renderings leaves the syllogism less open to the imputation of *petitio principii.* (*Calcutta University*, 1894)

Whately's version.

*version* of the Dictum is, "Whatever is predicated, (*i.e.*, affirmed or denied) universally, of any class of things, may be predicated, in like manner (*viz.*, affirmed or denied), of anything comprehended in that Class." (*Logic*, p. 23.) *Mill's version* is, "Whatever can be affirmed (or denied) of a class, may be affirmed (or denied) of everything included in the class." (*System of Logic*, I, p. 197.) Mr. Carveth Read's version is, "Whatever we have reason to regard as constantly connected with the nature or connotation of a class or class name, we may expect to be similarly connected with whatever can be shown to have that nature or connotation." (*Logic*, p. 160.)

Mill's version.

Read's version.

Some hold that Mill's version is less objectionable.

It has been held by some that Mill's version leaves the syllogism less open to the charge of *petitio principii*, because the word "universally" is not present in it. In Whately's rendering, "Whatever is predicated universally of any class of things" means, it is urged, that the predication is about everything belonging to the class. And if so, whenever we state the major premise, we know the conclusion, since it refers to things already known as members of the class. Mill's version, on the other hand, does not explicitly mention that the predication is about a class "universally." And so, it is contended by the supporters of this view, the conclusion is not known when the universal premise is asserted.

But this view is not tenable.

It may be said, however, that so far as the use of the term "universally" is concerned, the difference

between the two versions is rather nominal than real. Mill's statement, unless suicidal, must imply the class as taken universally or distributively, and not collectively: if class be taken collectively, then evidently we are not justified in affirming or denying of an individual included in it any quality or attribute which may be predicated of it as a whole. So, visibly or invisibly, the word 'universally' is present in, nay essential to, both the versions. We should remember that the question here is not one of visual or auditory perception but of logical necessity or mental apprehension. And, on an examination of the two versions, we find that 'universally' is present in both the cases—explicitly in the one, while implicitly in the other.

Whately's version seems to be less objectionable.

It would seem, therefore, that Whately's version leaves the syllogism less open to the charge of *petitio principii.* When he writes, "Whatever is predicated universally of any class of things, may be predicated, *in like manner*, of anything comprehended in that class," he evidently takes the universal major premise to be a datum in deductive logic, the determinate range of which is not known. If, now, by observation or otherwise, an individual or individuals be found to belong to the class, then whatever is already *given* predicated of it may *in like manner* be predicated of the individual or individuals. This is evidently nothing more than the statement of what can legitimately be inferred from the given premises according to the fundamental principles of consistency; and it does not, in the

least, imply that the truth of the conclusion was already presupposed by the universal premise.

The range of a universal proposition is supposed to be known in Mill's version, but not so in Whately's.

The question is whether the range of a universal proposition is definitely present before our mind,—Whether we know that so many or such and such individuals are included in the class expressed by the subject ? Mill's rendering implies an affirmative answer to the question; while Whately's a negative. The presence of the word 'is' in Whately's translation shows that he treats the universal major premise as an assumption, the precise range of which is not known; while the expression 'can be' in Mill's rendering points to the fact that the premise is accepted after careful and sufficient inspection and thus with its precise range known,—so that any inference deduced from such a premise cannot but involve the fallacy of *petitio principii*. He explicitly states in his Logic, "When you admitted the major premise you asserted the conclusion; but says Archbishop Whately, you asserted it by implication merely: this, however, can here only mean that you asserted it unconsciously; that you did not know you were asserting it; but, if so, the difficulty revives in this shape—Ought you not to have known? Were you warranted in asserting the general proposition without having satisfied yourself of the truth of everything which it fairly includes? And if not, what then is the syllogistic art but a contrivance for catching you in a trap and holding you fast in it?" (*Logic*, I, p. 209.)

It may be mentioned in this connection that this account of Mill, though countenanced by his objective view (which inclines him to keep close to facts), is consistent neither with his connotative theory of predication nor with his contention that the leap into the unknown is an essential feature of every inductive generalization.

Inconsistency of Mill.

Mr. Read remarks that the syllogism formally considered may be said to involve the fallacy of *petitio principii*; but materially considered it does not involve the fallacy. Formally, when we say anything of 'all', it must also be true of 'some' included in 'all'; but, materially, the range of 'all' being indeterminate, we can never directly infer from it anything with regard to a particular case. "That whatever is true of all is true of some," observes Mr. Read, "is a merely formal subaltern inference: knowing 'all', how can there be any question about the 'some'? But if we do not know 'all', not really the 'whole class', we must write the *dictum* thus: *Whatever we have reason to regard as constantly connected with the nature or connotation of a class or class name, we may expect to be similarly connected with whatever can be shown to have that nature or connotation.* Thus the feeding upon herbage, being connected with the nature of ruminants, is connected with camels, because they ruminate. Another way of putting this principle is *Nota notæ, nota rei ipsius*, 'the mark of a mark is a mark of the thing itself,' or whatever has a mark

Mr. Read contends that the syllogism formally involves a petitio, but not materially.

Connotative interpretation of the Dictum.

Nota Notæ.

has what it is a mark of.'* A mark is anything (A) that is never found without something else (B); so that where we find A, B may be expected. Now a camel is a mark of ruminating; and ruminating is a mark of feeding upon herbage: therefore a camel is a mark of feeding upon herbage." (*Logic*, pp. 159-160).

The connotative interpretation of the dictum is the most acceptable.

Mr. Read's interpretation of the *dictum* is, no doubt, the most acceptable. But, it may be mentioned, with reference to his remark about the formal syllogism, that rightly construed it does not necessarily involve the *petitio principii*. The 'all', no doubt, includes the 'some', but the 'some' must be known to possess the characteristics of the 'all' before it can be brought under it. And this is precisely the function of the minor premise to indicate; it shows that the 'some' really comes under the 'all'—that a case is present to which the universal rule can safely be applied. Thus, the conclusion in any case does not follow from the major premise alone, nor from the minor alone, but from the two taken together.

The syllogism does not involve petitio either formally or materially.

The syllogism is but a part of an entire inferential process, involving both induc-

**§ 4. Importance of the Syllogism.** Those who seek in the syllogism the ground for all inference—the panacea for all our intellectual infirmities—must necessarily be disappointed in their expectations. Syllogism is but a part of an

* Mill puts it thus: "Whatever possesses any mark, possesses that which it is a mark of. Or, when the minor premise as well as the major is universal, we may state it thus: Whatever is a mark of any mark, is a mark of that which this last is a mark of." (*Logic*, I, p. 205.)

entire inferential process, characteristic of the human intelligence. The human mind, drawing an inference in any case, knows no barrier between Induction and Deduction, between Hypothesis and Analogy, but proceeds from step to step, until the required conclusion is reached. The factors, however, which are inseparably connected in any concrete case, may be viewed apart for scientific purposes; and such an isolated discussion of topics is conducive, as we have seen, to the determination of their essential features and conditions. (*Vide* Chap. I, § 6.) Thus, though induction and deduction actually run into each other, yet for logical purposes we discuss their characteristics and conditions separately, with a view to understand them better in their abstract simplicity. (*Vide* Chap. I, § 9.)

tion and deduction.

Hence, for the sake of scientific convenience, we have hitherto studied the nature and conditions of Deductive Inference, reserving for the next Book (Book III) a separate treatment of Induction. We should not, therefore, expect to find in Deduction or in the Syllogism what is really achieved by Induction. Syllogism, as the type of Deductive inference, merely undertakes to prove that what is true of a class is necessarily true of everything which may be found to possess its characteristics. We may rightly or wrongly arrive at a general proposition; it may be due to prejudice or passion, custom or association, instinct or reason. Syllogism accepts it as ready-found and does not inquire

**Without inquiring into the truth of the premises, the syllogism merely shows the conclusion which necessarily follows from them.**

into its correctness or incorrectness. Neither does it inquire into the validity of our knowledge of a particular instance, which is taken as an illustration of the general truth. But when the two are properly combined then the syllogism shows the iron chain—the logical necessity—which inevitably leads us from the premises to the conclusion. And this inevitable necessity reveals also that we can never be too much careful of our premises. The syllogism thus brings out, on the one hand, that a valid conclusion rests in every case on adequate data or grounds; and it brings home to us, on the other, the responsibility which we are under in assuming or establishing a general truth. A false universal premise, thoughtlessly assumed, may become the source of erroneous conclusions and so, at times, of disastrous consequences, not only to ourselves, but also to others—even to future generations. And this responsibility is not so powerfully impressed on us by inductive reasoning as by the illative process illustrated in the syllogism.

The syllogism clearly reveals (1) the logical necessity involved in the inferential process.

and (2) the responsibility which we are under in establishing a universal proposition.

## § 5. Miscellaneous Exercises.

1. Point out the importance of Inference as an instrument of knowledge.

When can it be said to involve the fallacy of petitio principii?

2. State and examine Mill's objections to the syllogism as a mode of argument.

3. Syllogistic reasoning is said to be hypothetically necessary in character. How?

4. Of the two versions of the *Dictum de omni et nullo*

given by Whately and Mill, which one leaves the syllogism more open to the charge of *petitio principii* ?

5. Test the following arguments :—

(1) John is too weak to walk.

(2) No one is rich who has not enough ; no miser has enough : therefore, no miser is rich.

(3) The earth is a globe ; we live on the earth : therefore we live on a globe.

(4) Wealth cannot be the highest good, because we do not seek wealth for its own sake, but only as a means to something else.

(5) The greedy alone are unscrupulous ; but Jadu is greedy : so he must be unscrupulous.

(6) All sensation is certain and indisputable ; the only test and measure of certitude is therefore sensation.

(7) Not all creatures can fly ; but birds are creatures : therefore they cannot fly.

(8) Frequently work is wholly transformed into heat; heat is therefore capable of being wholly transformed into work.

(9) The intelligible alone can work out the problem ; but James is intelligent : therefore, he can solve the problem.

(10) Gravitation imparts the same velocity to all bodies ; therefore, a piece of lead and a feather (in a vacuum) will fall at the same rate.

(11) Nothing is better than wisdom ; dry bread is better than nothing : therefore, dry bread is better than wisdom.

(12) Beggars, who have no property, can receive no injustice, because injustice is nothing but violation of property.

(13) Since all metals are elements, the most rare of all the metals must be the most rare of all the elements.

(14) I know Brown is a genius, for geniuses are eccentric, and he also is so.

(15) The formal study of Logic is useless, for many persons who have never studied Logic can reason shrewdly and accurately.

(16) Projectors are unfit to be trusted ; this man has formed a project : therefore, he is unfit to be trusted.

(17) Movements of atoms are the only changes in the world we know anything about. Therefore, all the changes in the world are movements of atoms.

(18) None but the honest can be trusted ; but James cannot be trusted : therefore, he is not honest.

(19) He is, to be sure, a highly-educated man, but all highly-educated men are not qualified to be inspectors.

(20) If Parr's life pills are of any value, those who take them will improve in health ; now my friend who has been taking them has improved in health ; therefore, they are of value.

(21) How can pain be an evil, since remorse involves pain, and it is a real good?

(22) Some of Galileo's contemporaries argued: There can be no truth in Galileo's assertion that Jupiter has moons, because they are invisible to men, and can therefore have no bearing on the interests of mankind, and there can be nothing in this world that has not some relation to man.

(23) Presumptuous men are arrogant ; but John has presumed what he should prove ; therefore John is arrogant.

(24) This substance cannot be gold ; it is not malleable.

(25) James is too shrewd to be deceived.

(26) If it be fated that you recover from your present disease, whether you call in a doctor or not, you will recover ; again, if it be fated that you do not recover from your present disease, whether you call in a doctor or not, you will not recover ; but one or other of the contradictions is fated : therefore to call in a doctor is of no consequence.

(27) To err is human.

(28) A wise lawgiver must either recognise the rewards and punishments of a future state, or must be able to appeal to an extraordinary Providence, dispensing them regularly in this life ; Moses did not do the former : therefore he must have done the latter.

(29) If he pleads that he did not steal the goods, why I ask, did he hide them, as no thief ever fails to do.

(30) Poetry must be either true or false: if the latter, it is misleading; if the former it is disguised history, and savours of imposture as trying to pass itself off for more than it is. Some philosophers have therefore wisely excluded poetry from the ideal commonwealth.

(31) Calcutta and Cuttack must be the same, for there are Tin Konia Bagichas in both.

(32) Improbable events happen almost every day: but what happens almost every day is a very probable event; therefore, improbable events are very probable events.

(33) We avoid pain; therefore we seek pleasure.

(34) That man is independent of the caprices of Fortune who places his chief happiness in moral and intellectual excellence: a true philosopher is independent of the caprices of Fortune; therefore, a true philosopher is one who places his chief happiness in moral and intellectual excellence.

(35) War is productive of evil; therefore peace is productive of good.

(36) Either our soul perishes with the body and thus, having no feelings, we shall be incapable of any evil; or if the soul survives the body, it will be more happy than it was in the body: therefore death is not to be feared.

(37) A negro is a man; therefore, the strongest negro is the strongest man.

(38) If everlasting favour of God is not bestowed at random, and on no principle at all, it must be bestowed either with respect to men's persons, or with respect to their conduct: but God is no respector of persons: therefore His favour must be bestowed with respect to men's conduct.

(39) If a man be perfectly happy, he is virtuous. James is virtuous; therefore he is happy.

(40) Is a stone a body? Yes. Then is not an animal a body? Yes. Are you an animal? I think so. Ergo, you are a stone, being a body.

(41) No dishonest men are reliable; and honest men are not hypocrites.

(42) Why, if thou never wast at court, thou never sawest good manners; if thou never sawest good manners, then thy manners must be wicked; and wickedness is sin, and sin is damnation. Thou art in a perilous state, shepherd.

(43) Mahomed was a wise law-giver, for he carefully studied the character of his people.

(44) If transportation is not felt as a severe punishment, it is in itself ill suited to the prevention of crime: if it is so felt, much of its severity is wasted, from its taking place at too great a distance to affect the feelings, or even come to the knowledge, of most of those whom it is designed to deter; but one or other of these must be the case: therefore transportation is not calculated to answer the purpose of preventing crime.

(45) He must be an Englishman, for all Englishmen hold such views.

(46) The end of a thing is its perfection; death is the end of life: therefore, death is the perfection of life.

(47) It is unnecessary to lend books, if they are common; and wrong to lend them, if they are rare. Therefore, books should not be lent from public libraries.

(48) Cloven feet being found universally in horned animals, we may conclude that this fossil animal, since it appears to have had cloven feet, was horned.

(49) He who is most hungry eats most; but he who eats least is most hungry: therefore he who eats least eats most.

(50) If I write long letters he is bored: if short, he is offended: therefore I won't write at all.

(51) All cold is to be expelled by heat; this person's disorder is a cold: therefore it is to be expelled by heat.

(52) Since the end of poetry is pleasure, that cannot be unpoetical with which all are pleased.

(53) If he robs, he is not honourable; if he pays all his dues, he does not rob: therefore, if he pays all his dues, he is honourable.

(54) Profit is interpreted in the dictionary as 'advantage'; to take profit, then, is to take advantage. It is wrong to take advantage of another's difficulty; therefore it is wrong to take profit.

(55) It is manifest, indeed, that man, so far as he is a man, for the glory of God, must be an end unto himself, for it is only in the accomplishment of his own perfection that, as a creature, he can manifest the glory of his Creator.

(56) No imperfect beings are happy; and no created beings are perfect.

(57) Wilkes was a favourite with the populace; he who is a favourite with the populace must understand how to manage them: he who understands how to manage them, must be well acquainted with their character: he who is well acquainted with their character, must hold them in contempt: therefore, Wilkes must have held the populace in contempt.

(58) If all the accused were innocent, some at least would have been acquitted; we may infer, then, that some were innocent, since none have been acquitted.

(59) Are honours and rewards, public or private, to be pronounced useless, because they cannot influence the stupid, and men of genius rise above them?

(60) "He that is of God heareth God's words: Ye therefore hear them not, because ye are not of God." *St. John*, VIII, 47.

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wide reading and original thought. Your calmness and persuasiveness add much to the charm of the book. No one can fail to be interested by your style and very happy and appropriate poetical quotations. Throughout the book there are manifest signs of sincerity, and the aroma of absolute fairness pervades the whole book." *Dated Punjab, May 15, 1912.*

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"The idea of the book may be described as an attempt to explain moral principles with special reference to their concrete application. With a view to this end Prof. Mitra has entered into a careful study of the chief moral problems and a critical estimate of the leading ethical systems of the East and the West. His account and criticisms of the systems of so many schools of ancient and modern times—from Vedantism and Platonism to Positivism and Hegelianism —are always clear, concise and accurate. His estimate of the views of Mill, Bain, Martineau and Calderwood is at once precise and lucid ; and his remarks are always appropriate and just. The chapters on the Perplexity of Conscience, Duties and Rights, Virtue and Wisdom are very instructive and are calculated to foster the growth of a healthy moral character. As a text-book, it is valuable, not merely for its covering the B.A. syllabus in Ethics, but also for its wholesome practical teachings. The marginal notes will be very useful to examinees." *Dated June 29, 1912.*